

Final Report

**Mammal Inventory of
Padre Island National Seashore**

Jennifer K. Frey and Gerrad D. Jones

Department of Fishery and Wildlife Sciences
New Mexico State University
P.O. Box 30003, MSC 4901
Las Cruces, New Mexico 88003-8003
575-646-3395
jfrey@nmsu.edu

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to

Mark J. Biel, Acting Chief
Science and Resources Management Division
Padre Island National Seashore
PO Box 181300
Corpus Christi, TX 78480-1300

and

Gulf Coast Network
635 Cajundome Blvd.
Abdalla Hall, Suite 122
Lafayette, LA 70506

PREFACE

This report presents final results of a comprehensive mammal inventory of Padre Island National Seashore, Texas. Jennifer K. Frey developed the original overall scope and methodology of the study. The study formed the basis for the Master of Science thesis research in Wildlife Science at New Mexico State University by Gerrad D. Jones, under the direction of Jennifer Frey. The majority of the final report is based on the finalized Master's thesis. Management recommendations are included following the thesis contents.

Table of Contents

I. Thesis

Title page	i
Abstract	ix
Chapter 1: The mammals of Padre Island National Seashore, Texas	
Introduction	1
Materials and Methods	12
Results	21
Annotated List of Mammals	
Present, probably present	24
Encroaching, historical, unconfirmed, false reports	90
Discussion	122
Chapter 2: Small mammal community structure in the lower region of the coastal Texas prairie	
Introduction	127
Materials and Methods	127
Results	137
Discussion	142
Literature Cited	148
Figures	166
Tables	178
Appendices	189

II. Management Recommendations 269

Mammalian Zoogeography of Padre Island National Seashore, Texas

By

Gerrad David Jones, B.S. Biology

A thesis submitted to the Graduate School in partial fulfillment of the requirements for the
degree
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"Mammalian Zoogeography of Padre Island National Seashore, Texas," a thesis prepared by
Gerrad David Jones in partial fulfillment of the requirements for the degree, Master of Science,
has been approved and accepted by the following:

Linda Lacey
Dean of Graduate School

Jennifer K. Frey
Chair of the Examining Committee

Date

Committee in Charge
Dr. Jennifer K. Frey, Chair
Dr. Gary W. Roemer
Dr. Walter G. Whitford

DEDICATION

To my family, especially my parents, Ron and Theresa Jones, who have been the greatest sources of inspiration and encouragement in my life. Thank you so much for everything.

To all the naturalists who ever have or ever will set foot on Padre Island...may this document serve you well.

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VITA

EDUCATION

M.S. Water Resources and Environmental Engineering, Villanova University, Villanova, Pennsylvania: August 2007-Present, GPA 4.0 Expected Graduation May 2010
M.S. Fishery and Wildlife Science, New Mexico State University, Las Cruces, New Mexico: January 2005-Present, GPA 4.0 Expected Graduation May 2008
B.S. Biology, Truman State University, Kirksville, Missouri: 2000-2004, Magna Cum Laude, GPA 3.75

PUBLICATIONS

Jones, G.D., and J.K. Frey. In Press. First records of gray fox (*Urocyon cinereoargenteus*) on Texas barrier islands. *Texas Journal of Science*.

Jones, G.D. 2005. Characterization of Benthic Invertebrates in Bear Creek: an Analysis of Stream Health at Truman State University, Kirksville, Missouri. University Press, Truman State University, Kirksville, Missouri.

Jones, G.D. 2004. The Current Status of the Bobcat (*Lynx rufus*) in Northeast Missouri. *McNair Scholarly Review*. 10(1): 115-130

CONFERENCE PRESENTATIONS

Jones, G.D., and J.K. Frey. 2007. An enigma of the species-area relationship: small island effect on coastal Texas islands. Poster Presented at the American Society of Mammalogists, Albuquerque, New Mexico.

Jones, G.D. and J.K. Frey. 2007. An Enigma of the Species-area relationship: small island effect of coastal Texas islands. Paper Presented at the Southwestern Association of Naturalists in Stephenville, Texas.

Jones, G.D., K.M. Otten, C. R. Wampler, Z. Schwenke, and J. K. Frey. 2006. Status and Habitats of the Threatened Least Shrew (*Cryptotis parva*) in New Mexico. Paper Presented at The Wildlife Society meetings in Flagstaff, Arizona.

Jones, G.D. and M.S. Burt. 2005. Geographic Variability in Call Structure of the Big Brown Bat (*Eptesicus fuscus*) in Missouri. Poster Presented at the Southwestern Association of Naturalists meetings in Huntsville, Texas.

Jones, G.D. and G. Shinn. 2004. Characterization of Benthic Invertebrates in Bear Creek: an Analysis of Stream Health at Truman State University, Kirksville, Missouri. Paper presented at the Truman State University Earth Day Research Celebration.

Jones, G.D. and M.S. Burt. 2003. The Current Status of the Bobcat (*Lynx rufus*) in Northeast Missouri. Paper presented at Penn State University McNair Research Conference, State College, Pennsylvania.

PROFESSIONAL AFFILIATIONS

2005-2006	South Western Association of Naturalists
2004-2007	American Society of Mammalogists
2002-2004	Alpha Chi Sigma: Chemistry Honors Society
2001-2004	Beta Beta Beta: Biological Honors Fraternity
	Treasurer: 2002-2003
	Academic Chair: 2003-2004

ABSTRACT

MAMMALIAN ZOOGEOGRAPHY OF PADRE ISLAND NATIONAL SEASHORE, TEXAS

By

Gerrad David Jones, B.S.

New Mexico State University

Las Cruces, New Mexico

2008

Dr. Jennifer K. Frey, Chair

Padre Island is the largest barrier island in the world, extending from Corpus Christi to Port Isabel along the Texas coast. Although parts of Padre Island are developed, Padre Island National Seashore (PAIS) is the largest stretch of undeveloped barrier island in the world and is dominated by coastal prairie. The coastal prairie ecosystem is the southernmost unit of the tallgrass prairie biome and reaches its southern extent on Padre Island. Despite numerous investigations examining community structure in grasslands, little research has been conducted on small mammals in coastal prairie ecosystems. Thus, the goals of this study were to 1) conduct a baseline mammal survey of Padre Island, 2) describe the habitat associations of small mammals, 3) determine the mechanism(s) structuring small mammal communities, and 4) evaluate the broader patterns of species richness, diversity, and community structure.

The mammal fauna on Padre Island was determined through museum queries, literature surveys, and field surveys which occurred from May 2005 thru March 2007. Standardized Sherman trap transects were deployed to evaluate small mammal communities. Habitat data were collected at on each transect. Mann-Whitney U tests, principal components analysis, linear regression, and logistic regression were used to describe the habitat associations. Linear regressions, correlations, and discriminant function analysis were used to examine community structure. Hierarchical cluster analysis and discriminant function analysis were used to evaluate community patterns. Linear regression was used to determine which variables were responsible for small mammal richness and diversity.

On Padre Island, 62 species of non-marine mammals were documented or reported. Within PAIS, 26 species were present or probably present, 19 were encroaching, 9 were unconfirmed, 6 were historical, and 2 were false reports. Habitat selection was the overriding mechanism structuring small mammal communities. Interspecific interactions were detected for some species. Northing was the best predictor of richness and alpha diversity. Alpha diversity was nearly 8 times less than beta diversity and was considerably lower than other grasslands within North America. The relatively impoverished fauna within PAIS is likely a result of the island nature of the system and habitat selection of tallgrass prairie and desert grassland adapted mammals.

LIST OF FIGURES

Figure 1. Coastal counties surrounding Mustang and Padre Islands.....	164
Figure 2. Map of South Texas including place names used to describe boundaries and locality records for mammals.	165
Figure 3. Packery Channel is the current boundary between Mustang and North Padre Island.	166
Figure 4. Comparison of vegetation from similar areas of North Padre Island between circa 1950 and 2005.....	167
Figure 5. Important place names in northern PAIS used to describe current and historical localities.....	168
Figure 6. Cross-section of North Padre Island	169
Figure 7. Locations of all standardized and non-standardized transects set during this study	170
Figure 8. Division of the upper and lower coastal prairie in Texas.....	171
Figure 9. Locations of 140 standardized transects on Padre Island National Seashore	172
Figure 10. Habitat summary of 129 standardized transects within Padre Island National Seashore	173
Figure 11. Nine mammal clusters formed two species branches that were dominated by tall grass and desert adapted species	174
Figure 12. Species accumulation curves based on northing and effort.....	175

LIST OF TABLES

Table 1. Bat mist-netting effort within PAIS from 2005-2007	176
Table 2. Trapping effort and results of mammal surveys on 14 small islands in the Laguna Madre.	177
Table 3. Color morphs of the Gulf Coast kangaroo rat vary considerably among populations on barrier islands in the Gulf of Mexico.....	178
Table 4. Habitat associations of small mammals on Padre Island National Seashore based on linear and logistic regression models.....	179
Table 5. Interspecific interactions between species based on partial and Spearman correlations	181
Table 6. Linear regression models predicting increased relative abundance based on species presence and habitat variables.....	182
Table 7. Effectiveness of the discriminant functions in separating mammal clusters based on relative abundance of all 8 species.....	183
Table 8. Species composition of mammal clusters derived from hierarchal cluster analysis	184
Table 9. Linear regression models explaining increased richness and alpha diversity	185
Table 10. Regression models predicting increased richness and diversity.....	186

LIST OF APPENDICES

APPENDIX I. Museums reporting specimens From Mustang, North Padre, and South Padre Islands	189
APPENDIX II. Locations where camera traps were set during this study	191
APPENDIX III. Checklist of the Mammals offrom Padre Island National Seashore	194
APPENDIX IV. Locations where <i>Dasyus novemcinctus</i> was documented within Padre Island National Seashore during this study	198
APPENDIX V. Locations where <i>Spermophilus spilosoma</i> was documented within Padre Island National Seashore during this study	200
APPENDIX VI. Locations where <i>Geomys personatus</i> was documented within Padre Island National Seashore during this study	202
APPENDIX VII. Locations where <i>Dipodomys compactus</i> was documented within Padre Island National Seashore during this study	204
APPENDIX VIII. Locations where <i>Baiomys taylori</i> was documented within Padre Island National Seashore during this study	206
APPENDIX IX. Locations where <i>Reithrodontomys fulvescens</i> was documented within Padre Island National Seashore during this study	208
APPENDIX X. Locations where <i>Onychomys leucogaster</i> was documented within Padre Island National Seashore during this study	210
APPENDIX XI. Locations where <i>Oryzomys palustris</i> was documented within Padre Island National Seashore during this study	212
APPENDIX XII. Locations where <i>Sigmodon hispidus</i> was documented within Padre Island National Seashore during this study	214
APPENDIX XIII. Locations where <i>Mus musculus</i> was documented within Padre Island National Seashore during this study	216
APPENDIX XIV. Locations where <i>Lepus californicus</i> was documented within Padre Island National Seashore during this study	218
APPENDIX XV. Locations where <i>Scalopus aquaticus</i> was documented within Padre Island National Seashore during this study	220

APPENDIX XVI. Locations where <i>Lynx rufus</i> was documented within Padre Island National Seashore during this study	222
APPENDIX XVII. Locations where <i>Urocyon cinereoargenteus</i> was documented within Padre Island National Seashore during this study	224
APPENDIX XVIII. Locations where <i>Canis latrans</i> was documented within Padre Island National Seashore during this study	226
APPENDIX XIX. Locations where <i>Taxidea taxus</i> was documented within Padre Island National Seashore during this study	228
APPENDIX XX. Locations where unidentified skunks were documented within Padre Island National Seashore during this study	230
APPENDIX XXI. Locations where <i>Procyon lotor</i> was documented within Padre Island National Seashore during this study	232
APPENDIX XXII. Locations where <i>Odocoileus virginianus</i> was documented within Padre Island National Seashore during this study	234
APPENDIX XXIII. Habitat comparisons between transects where <i>Spermophilus spilosoma</i> was present and absent.....	236
APPENDIX XXIV. General habitat description of <i>Spermophilus spilosoma</i>	238
APPENDIX XXV. Habitat comparisons based on Mann-Whitney U tests between transects where <i>Dipodomys compactus</i> was present and absent.....	240
APPENDIX XXVI. General habitat description of <i>Dipodomys compactus</i>	242
APPENDIX XXVII. Habitat comparisons based on Mann-Whitney U tests between transects where <i>Baiomys taylori</i> was present and absent.....	244
APPENDIX XXVIII. General habitat description of <i>Baiomys taylori</i>	246
APPENDIX XXIX. Habitat comparisons based on Mann-Whitney U tests between transects where <i>Reithrodontomys fulvescens</i> was present and absent.....	248
APPENDIX XXX. General habitat description of <i>Reithrodontomys fulvescens</i>	250
APPENDIX XXXI. Habitat comparisons based on Mann-Whitney U tests between transects where <i>Onychomys leucogaster</i> was present and absent.....	252

APPENDIX XXXII. General habitat description of <i>Onychomys leucogaster</i>	254
APPENDIX XXXIII. Habitat comparisons based on Mann-Whitney U test between transects where <i>Oryzomys palustris</i> was present and absent.....	256
APPENDIX XXXIV. General habitat description of <i>Oryzomys palustris</i>	258
APPENDIX XXXV. Habitat comparisons based on Mann-Whitney U test between transects where <i>Sigmodon hispidus</i> was present and absent.....	260
APPENDIX XXXVI. General habitat description of <i>Sigmodon hispidus</i>	262
APPENDIX XXXVII. Habitat comparisons based on Mann-Whitney U tests between transects where <i>Mus musculus</i> was present and absent	264
APPENDIX XXXVIII. General habitat description of <i>Mus musculus</i>	266

THE MAMMALS OF PADRE ISLAND NATIONAL SEASHORE, TEXAS

Although the flora and fauna of many islands have been thoroughly investigated, the majority of archipelagos are largely understudied (Hice and Schmidly 2002, Pilkey 2003). Barrier island chains are no exception. These complex island systems are found on every continent except Antarctica, and are most extensive in North America (Pilkey 2003). Approximately one fourth of all barrier islands are found in the United States. With almost 5,000 kilometers of barrier island shoreline, the United States has the largest number (405) of barrier islands in the world (Pilkey 2003).

Barrier islands are dominant features of coastal areas including Texas. Approximately two-thirds of the Texas coastline is bordered by 6 major islands, the largest of these being Padre Island (Figure 1). Padre Island is the largest barrier island in the world and extends approximately 180 kilometers from Corpus Christi south to Port Isabel (Pilkey 2003). Along its length, Padre Island traverses, from north to south, Nueces, Kleberg, Kenedy, Willacy, and Cameron counties (Figure 1).

Geologic History.--Although the origin of barrier islands has been debated, it is likely that several processes were involved in the formation of barrier islands in the Gulf of Mexico, including Padre Island (Schwartz 1971, Weise and White 1980, Pilkey 2003). Three theories of barrier island formation in the Gulf of Mexico have been generally accepted. These include submersion of offshore sand ridges, development from submerged shoals and sandbars, and spit accretion (Schwartz 1971, Weise and White 1980). Approximately 18,000 years before present (ybp), worldwide sea levels were 300-450 feet below current levels (Curry 1960). At the end of the Pleistocene, rising sea levels from glacial melting inundated sand ridges which

may have served as the foundation for barrier islands (Weise and White 1980). As sea levels rose, currents and waves carried sand toward the shore, continually eroding and forming new sandbars which provided the sand for barrier islands (Weise and White 1980). Approximately 5,000-4,500 ybp, at the end of the Holocene, sea levels began to stabilize allowing submerged sand shoals to coalesce (Fisk 1959, Schwartz 1971). Flooded river valleys and other low lying areas from the mainland created irregular shoreline profiles, forming bays and estuaries (Weise and White 1980). Long shore currents formed barrier spits, or extensions of the shoreline across these bays and estuaries (Price and Gunter 1943, Tunnel and Judd 2002, Davis and Fitzgerald 2003). Once formed, approximately 3,000 ybp, the barrier islands of Texas were shaped by winds, tides and storms that entered the Gulf of Mexico (Weise and White 1980, Tunnel and Judd 2002).

Much like Padre Island, the formation of the Laguna Madre of Texas and Tamaulipas occurred during the end of the Pleistocene and through the Holocene epochs (Tunnel and Judd 2002). The Laguna Madre of Texas (hereafter referred to as Laguna Madre) is a hypersaline lagoon that separates Padre Island from the mainland of Texas (Figure 1, Figure 2). The formation of Padre Island trapped sea water between it and the mainland. Because of little freshwater inflow, high evaporation, and limited exchange with Gulf waters, the water within this system became increasingly saline. While the salinity in the Gulf of Mexico varies between 28-32 parts per thousand, the salinity in the Laguna Madre varies from 40-80 parts per thousand (Tunnel and Judd 2002).

By the early 1940's, considerable changes had occurred on Padre Island. In 1941, an active dune field covered 18% of northern portions of Padre Island (White et al. 1978). Winds

carried sand and sediments from Padre Island and deposited them into the Laguna Madre (Price and Gunter 1943). By 1943, Padre Island was connected to the mainland completely dividing the Laguna Madre into upper and lower portions (Figure 2; Price and Gunter 1943).

By 1949, Padre Island was separated from the mainland by the construction of the Intracoastal Waterway, a 12' deep by 125' channel connecting the inland waters from Florida to Texas (Alperin 1983). Within larger bodies of water such as the Laguna Madre, dredged material was piled to form small (~3-4 ha) islands known as dredged material islands or spoil islands. These islands line the coast of Texas and are prevalent features in the Laguna Madre.

Although once continuous, Padre Island is now separated into North and South Padre islands by the Mansfield Channel (Figure 2). This channel was constructed between the Laguna Madre and the Gulf of Mexico in 1957 to promote shipping from the Gulf of Mexico into the Intracoastal Waterway (Morton and Pieper 1977). Within months of its completion, however, the channel was filled with sediments as a result of storms and tidal action. In 1962, a second channel was constructed with protective jetties that now separate the two islands (Morton and Pieper 1977). For temporal clarification, the use of Padre Island will refer to the status of the island before the construction of the Mansfield Channel and the qualifiers of North and South Padre islands will be used to describe the status of the island after.

Historically, water from the Gulf of Mexico flowed into the Upper Laguna Madre through Corpus Christi Pass (Figure 2, Figure 3; Williams et al. 2007). Corpus Christi Pass was a natural land cut that traversed a nearly north to south path from the Laguna Madre to the Gulf of Mexico. Although Corpus Christi Pass formed the boundary between Mustang and

Padre islands, the pass was repeatedly closed and reopened as a result of currents and hurricanes from the Gulf of Mexico (Williams et al. 2007, R. Watson pers. com.). As a result of these dualistic forces, Mustang and Padre islands were repeatedly connected in the past. In 1924, the construction of Aransas Pass changed the hydrology of Corpus Christi Pass (Figure 2; Williams et al. 2007). Water from the Gulf of Mexico that normally flowed through Corpus Christi Pass was redirected through Aransas Pass. This cut off the water supply through Corpus Christi Pass causing it to fill with sediments (Williams et al. 2007). By 1938, Mustang and Padre Island were connected (Baker and Lay 1938). In 2003, construction began on extending the existing Packery Channel in the Laguna Madre to the Gulf of Mexico (Figure 3). By 2006, Packery Channel was completed with protective jetties making a more permanent boundary between Mustang and North Padre Islands (Williams et al. 2007).

Vegetation.--The earliest and most basic descriptions of the vegetation on Padre Island come from European explorers. From 1519-1800, European activity on Padre Island was minimal; however, the earliest descriptions of the vegetation come from journals of sailors and military personnel (Sherrod and Brown 1989). Although various descriptions of sand dunes and grasslands with little mention of trees were recorded, vegetative descriptions were generally scant during this period (Sherrod and Brown 1989). The first clear descriptions of the habitat occurred in 1745, when a ship commanded by Chevalier Grenier was shipwrecked on Padre Island. In his journal he wrote, "This is a low land without trees nor even any shrubby trees.... At fifty paces from the sea there are shifting sand dunes that separate the beach from a prairie interspersed with salty lakes where there is the best pasturage in the world...." (Sherrod and Brown 1989).

Although few descriptions of the vegetation exist before 1800, first hand accounts of the vegetation following 1800 exemplified changes that occurred along the length of Padre Island. In 1828, approximately 24 years after ranching operations began on Padre Island, the first land survey was conducted by Domingo de la Fuente (Weise and White 1980, Sherrod and Brown 1989). De la Fuente traveled across the entire length of island from south to north, noting land features and vegetation. After the first day of surveying, de la Fuente wrote, “nothing was encountered but sand dunes, some salty bays, and very few, poor pastures....” (Sherrod and Brown 1989). The vegetative cover increased and pasture quality improved as de la Fuente moved north, and at the northern end of Padre Island, de la Fuente described the land as a “large flat pasture with well covered dunes” (Sherrod and Brown 1989). In 1846, a Texas Ranger, Samuel Reid, described the island as a “sand waste” and likened it to the “Sahara Desert” (Reid 1847). In describing the southern end of Padre Island, Major W.G. Thompson wrote “The Island itself is small and worthless being only sand and a perfect waste” (Sherrod and Brown 1989). Thomas Noakes, a resident of Corpus Christi, spent a week on Padre Island in 1865 and wrote, “The Island here was nothing but loose white sand, with a very little very coarse grass which the horse would not eat....” (Sherrod and Brown 1865). Patrick Dunn, founder and longtime owner and operator of the Dunn Ranch, claimed the verdure of Padre Island ended after 1870 (Price and Gunter 1943).

Several factors in addition to grazing are likely to have contributed to the reduction of vegetation during the late 19th and first half of the 20th centuries on Padre Island (Price and Gunter 1943). For example, the U.S. Navy used the island as a training range for bombing. Since 1527, at least 78 hurricanes have hit the coast of Texas, 25 making landfall on Padre

Island (National Oceanographic Atmospheric Administration 2004). The earliest reports of widespread destruction caused by hurricanes on Padre Island come from the late 19th century. Between 1880 and 1890, four hurricanes hit Padre Island (NOAA 2004). In 1887, a hurricane hit the midsection of Padre Island, leveling the dunes a half-mile inland and removing almost all vegetation along a 40 mile stretch of the island (Bailey 1933). In 1919, storm surge inundated Padre Island with a mixture of water and sand, killing 3000 head of cattle (Price and Gunter 1943). Storm surge from back to back hurricanes in 1933 also flooded Padre Island (NOAA 2004). Morton and Pieper (1977) wrote, "The effects of the September 1933 hurricane on vegetation of southern Padre Island...were still visible on the 1937 photomosaics.... Except for the remnants, the southern half of Padre Island was virtually denuded." Almost immediately after these hurricanes, fire purportedly burned much of the northern part of Padre Island in 1934 and was followed by a severe drought that struck Texas (Sherrod and Brown 1989). Furthermore, in 1950, the worst drought in Texas history struck the state and lasted until 1957, which undoubtedly affected the vegetation on Padre Island.

The following decades marked the turning point in the vegetation on Padre Island (Figure 4). Following the 1950's drought, vegetation expanded considerably on Padre Island (White et al. 1978). Erosion decreased by 75%, while the vegetated dune and barrier flats more than doubled (White et al. 1978). Although the establishment of Padre Island National Seashore marked the end of cattle era on North Padre Island, cattle were allowed to graze within PAIS until 1971. Although a few stray cattle remained within PAIS until the mid 1970's, the vegetation on North Padre Island quickly recovered and began to resemble coastal prairie shortly after the removal of cattle (Figure 4; L. Moorehead pers. com.).

History of Mammals on Padre Island.--Prior to the first mammal surveys, the earliest accounts of mammals on Mustang and Padre islands come from the 18th century (Sherrod and Brown 1989). Journal entries from French and Spanish explorers, military personnel, and surveyors dating as far back as 1745 reported deer, hares, and hogs (Sherrod and Brown 1989) which likely translate to white-tailed deer (*Odocoileus virginianus*), black-tailed jackrabbit (*Lepus californicus*), and collared peccary (*Pecari tajacu*). Although these early accounts provide no information regarding small mammals, they provide valuable insights to the early composition of mammals especially in regards to large mammals. For example, in 1876 Halter wrote, "I use [a rifle] for protection against coyotes, wolves, and panthers which become more plenty as we go down the island" (Sherrod and Brown 1989).

The earliest mammal surveys including small mammals conducted on Padre Island were done in the late 19th and early 20th centuries. Although primarily through incidental trapping, a number of early specimens collected from Padre Island are included in papers written during the later 19th and early 20th centuries (True 1889; Allen 1891; Merriam 1893; Miller 1897; Osgood 1900; Howell 1901, 1914; Bailey 1905; Jackson 1915; Goldman 1918). The first records of bats on Padre Island were made during the late 19th century and included *Tadarida brasiliensis* and *Atalapha* sp. (*Lasiurus* sp.; Lloyd 1891, Allen 1893, Bailey 1905). Some species including *Perognathus merriami*, *Chaetodipus hispidus*, and *Conepatus leuconotus* are only reported from these early accounts (see annotated list of mammals for catalog numbers for *P. merriami* and *C. hispidus*).

Little work was conducted on the mammals of Mustang and Padre islands from the 1920's through the 1960's. Accounts during this time however provide invaluable information

on the distribution of various species on these islands (Baker and Lay 1938, Price and Gunter 1943, Blair 1952). Although these records fill in a gap between early surveys and work done after cattle were removed, it is worth while to note locality discrepancies. Baker and Lay (1938) report capture localities as: Mustang Island, 18 miles south Port Aransas. The currently recognized boundary (Packery Channel) is 28.2 km (17.5 mi) south Port Aransas by road (Texas state highway 321). In 1938, the boundary between Mustang and North Padre island was Corpus Christi Pass; however, where Texas State highway 321 crosses from Mustang Island to Padre Island, Corpus Christi Pass and Packery Channel overlap. Although the boundary between North Padre and Mustang Islands may have shifted over the years, 18 miles south Port Aransas is currently on North Padre Island. Furthermore, a hurricane washover channel, 4.00 km (2.48 mi) north of Packery Channel by State Highway 321, is labeled Corpus Christi Pass. This washover channel is not the historic boundary between the two islands; however, Koepke (1969) uses this washover channel as the distinction between the two islands.

The first annotated list of mammals on Padre Island was created by Raun (1959). This document compiled previous known records of mammals collected from literature in addition to species captured by him through limited trapping. This document offers little supporting information regarding capture localities, habitat, effort, or species' distributions on the island. Thomas (1972) and Rabalais (1975) created a checklist of the mammals of North Padre Island and PAIS, but no supporting information regarding species occurrence. Rather, it appears to be a compilation of species based on distribution maps from general mammal field guides. Within PAIS, N. Rabalais (pers. com.) did not conduct any surveys and instead compiled

species records, visitor observations, and included species that could possibly occur. Although these were the first efforts to compile information on mammals from these islands, they contain little scientific evidence of species presence on North and South Padre islands. Raun (1959) is only cited where supporting evidence either through trapping or observations are included while Thomas (1972) and Rabalais (1975) were not used as a citation in the annotated list of mammals.

Koepke (1969) conducted the first standardized mammal survey of Mustang and North Padre islands. On North Padre Island, his southern most trapping efforts occurred 6.4 km south of Bob Hall Pier, which is just north of the PAIS boundary. In 1,500 Sherman trap trapnights, 51 individuals were captured representing 6 rodent species, including *Spermophilus spilosoma*, *Dipodomys compactus*, *Onychomys leucogaster*, *Oryzomys palustris*, *Sigmodon hispidus*, and *Mus musculus*. Yzaguirre (1974) conducted a survey of the mammals within PAIS in relation to percent ground cover at ca. beach mile 9. In 1,890 Sherman trap trapnights, 62 individuals were captured representing 3 rodent species, including *Spermophilus mexicanus*, *D. compactus*, and *Peromyscus leucopus* (see annotated list of mammals for discussion of misidentifications of *S. mexicanus* and *P. leucopus*). Baccus et al. (1977) conducted floristic and mammal surveys at 4 localities within PAIS, ranging from the main entrance south to ca. beach mile 10. In 1,800 Sherman trap trapnights, 144 individuals were captured representing 4 rodent species including *Spermophilus spilosoma*, *Dipodomys compactus*, *Sigmodon hispidus*, *Baiomys taylori*, and *Reithrodontomys fulvescens*. Baker and Rabalais (1978) conducted the most extensive survey of the mammals of North Padre and Mustang islands in the 20th century, compiling records through literature searches and

conducting field surveys. This survey, however, was never published and lacks important details such as trapping effort and description of trapping areas. Harris (1988) conducted the last mammal survey of PAIS. In this study, trapping was restricted to the main entrance to South Beach. In 1,000 trapnights, 33 individuals were captured representing 6 small mammal species (*Spermophilus spilosoma*, *Dipodomys compactus*, *Oryzomys palustris*, *Baiomys taylori*, *Sigmodon hispidus*, *Mus musculus*). Five additional species were documented through sign, and a list of all species reported from the island was presented.

During the last quarter of the 20th century, interest in mammals on North Padre Island shifted from surveys to population ecology studies (Schmidly and Hendricks 1976, Kennedy et al. 1979, Baumgardner and Schmidly 1981, Baumgardner and Schmidly 1985, Segers and Chapman 1984, Smith 1986). The only study exploring community patterns on North Padre Island was conducted by Goetze et al. (1999) which was the last published study of mammals on North Padre Island.

Padre Island National Seashore.--Padre Island National Seashore was established in 1963 and encompasses 130,434 of acres on North Padre Island (National Park Service 2008b). Approximately 105 km (65 mi) of PAIS parallels the Gulf of Mexico while 110 km (69 mi) of the western edge is lined by the upper and lower Laguna Madre and extensive mudflats. Although PAIS was created to preserve coastal habitats for the purposes of public recreation (National Park Service 2008b), several factors make PAIS a particularly valuable area for maintaining biodiversity and preserving biological processes. At approximately 110 km in length, PAIS is the largest stretch of undeveloped barrier island in the world (National Park Service 2008b). PAIS also encompasses and protects a variety of habitats including coastal

prairie and hyper saline environments that are found few places in the world. Furthermore, because of its location along the Gulf Coast flyway, Padre Island as well as other barrier islands provides the first and last possible foraging opportunity for avian migrants crossing the Gulf of Mexico (Moore et al. 1990).

Increasingly, across the National Park Service decisions affecting park resources are made without sufficient biological information (Ruggiero et al. 1992). As a result, the Inventory and Monitoring Program was established in 1992 with the overall goal to maintain and manage the biodiversity within national parks (National Park Service 2008a). To appropriately manage the biodiversity within PAIS, it is necessary to document species and understand the factors contributing to their distribution within the park. Although some taxa are well documented in PAIS, relatively little work has been conducted on mammals across PAIS. What surveys that have been completed have been limited by sampling effort and total area sampled (Lloyd 1891, Koepke 1969, Yzaguirre 1974, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988). To adequately manage the mammal fauna within PAIS, a rigorous survey needs to be conducted along the park's entire length. In order to aid in the Inventory and Monitoring Program, and because a rigorous mammal survey has not been completed, the primary goal of this study was to evaluate the current and historical mammalian fauna on Padre Island with particular emphasis within PAIS. This was done through literature searches, museum queries, and field sampling using standardized, targeted, and opportunistic sampling techniques. By providing baseline data regarding the historical and current composition of the mammals and their habitat associations on PAIS, park personnel will be able to establish protocols for maintaining and monitoring populations within PAIS.

MATERIALS AND METHODS

Study Area.--Padre Island National Seashore was divided both latitudinally and longitudinally. Latitudinally, PAIS was divided into three sections using the standard conventions practiced by PAIS staff. From north to south, these sections include North Beach, Closed Beach, and South Beach (Figure 5). North Beach is considered the northern most 1.76 km (1.1 mi) section of beach within PAIS. Closed Beach encompasses is 7.34 km (4.6 mi) of beach, extends past the Malaquite Beach Visitor Center, and ends adjacent to the end of Park Road 22. Closed Beach is closed to vehicular traffic. South Beach begins at the end of Park Road 22 and extends 96.5 km (60.0 mi) to Mansfield Channel. South Beach was further divided using the conventions in place within PAIS. Beach miles indicate the distance south (by beach) from the end of Park Road 22 (or the start of South Beach) and were used to describe a particular cross section of PAIS. For example, beach mile 55 is located 55 miles south of the end of Park Road 22 by beach.

Longitudinally, the terrestrial environment on Padre Island was divided into 6 zones: beach (a), foredune (b), interdune (c), primary dune (d), interior (e), interior dune (f), and laguna matrix (g; Figure 6). These zones, with the exception of the interior dunes, are found from the shore of the Gulf of Mexico to the Laguna Madre respectively and are continuous along the length of the island. Although discontinuous, the interior dunes are common on the leeward side of the primary dune system.

The beach along the Gulf of Mexico (zone a) is gently sloped and is continually affected by wind, waves, tides, storm surges, and vehicular traffic. Although the beach is almost entirely devoid of vegetation, large quantities of sargassum (*Sargassum sp.*), a marine

algae, are deposited on the beach during spring and summer months (National Park Service 2008b). Other organic debris that washes ashore includes driftwood and fish. Inorganic debris including plastics and styrofoam also washes ashore, a majority of which comes from the shrimping industry, offshore natural gas platforms, and inland sources washing out from rivers and streams in the United States and Mexico (National Park Service 2008b).

Landward of the beach along most of Padre Island is a ridge of vegetated coastal sand dunes. This dune system can be subdivided into different components including foredune (zone b), interdune (zone c), primary dune (zone d), and interior dune (zone f). Immediately adjacent to the beach, the foredune exhibits a different floral community than the beach and is dominated by various species of morning glory (*Ipomoea imperati* and *Ipomoea pes-caprae*), in addition to sea oats (*Uniola paniculata*) and beach tea (*Croton punctatus*). The primary dune is more inland and is typically dominated by grasses including seacoast bluestem (*Schizachyrium scoparium*) and sea oats (*Uniola paniculata*) in addition to plains wild indigo (*Baptisia leucophaea*). When present, the interior dunes are similar to the primary dune in vegetation but are generally smaller. Between the foredune and primary dune, the interdune has similar vegetation to both the foredune and primary dune habitats. Although dunes can be found throughout Padre Island, they are concentrated adjacent to the beach. These dunes are fairly well stabilized by vegetation, except where vegetation has been removed by wind, water, or human activity (Drawe et al. 1978, Judd et al. 1989, D. Echols pers. com.).

Behind the dune system, coastal plain grassland dominates the majority of the interior of Padre Island. Dominant plant species of these vegetated flats include bushy bluestem (*Andropogon glomeratus*), seacoast bluestem, plains wild indigo, and gulfdune paspalum

(*Paspalum monostachyum*). Although these flats are dominated by species adapted to relatively dry environments, storm water collects in depressions to form emergent wetlands where bulrush (*Scirpus pungens* and *Scirpus americanus*), cattail (*Typha domingensis*), and the exotic reeds (*Phragmites australis*) are common. The salinity of these wetlands can vary resulting in floral communities that contain species tolerant of both fresh and salt water (National Park Service 2008b).

Extensive tidal flats composed of mud and sand are found along the western edge of Padre Island adjacent to the Laguna Madre. Although the majority of these flats are bare, shoregrass (*Monanthochloe littoralis*), quelite (*Atriplex arenaria*), and glassword (*Salicornia virginica*) are the major species present along the western edge of North Padre Island. Additionally, several small islands (< 1 km²), both natural and manmade, are found adjacent to Padre Island in the Laguna Madre. Natural islands, including North and South Bird islands, are low laying islands and are often inundated by salt water. Dominant plant species include wolfberry (*Lycium carolinianum*), cenicilla (*Sesuvium portulacastrum*), and sea purslane (*Sesuvium sessile*) as well as other salt marsh species. In addition to natural islands, manmade Dredged Material Islands, also known as spoil islands, exist within PAIS. The vegetation on Dredged Material Islands is variable, and islands separated by 90 meters could have very different vegetative communities, including non-native vegetation. However, species including black willow (*Salix nigra*), sea ox-eye daisy (*Borrchia frutescens*), and vidrillos (*Batis maritima*) are not uncommon.

Literature Searches.--Primary literature, field journals, personal accounts, and unpublished reports were examined to find information regarding the mammals of PAIS.

Literature search engines (ArticleFirst, BIOSIS, FirstSearch, Google Scholar, JSTOR, SciSearch, and Wildlife & Ecology Studies Worldwide) were used to find literature published on the mammal fauna of Mustang, North Padre, and South Padre islands by searching for key words such as barrier islands, coastal faunas, mammals, and Texas. In addition to primary literature, the field catalog of William Lloyd was obtained from the Southwest Collection, Special Collections Libraries at Texas Tech University. Lloyd conducted mammal surveys from Padre Island as part of the Biological Survey of Texas. Files at the Natural Resources and Interpretive offices within PAIS also were examined for relevant information. All documents containing references to mammals on Mustang, North Padre, and South Padre islands were used to assess the historical composition and distribution of mammals on these islands.

Museum Queries.--Twenty-two museums including national, regional, and local museums were queried to find specimens collected from Mustang, North Padre, and South Padre islands. Nineteen museums responded with records of 958 terrestrial mammal specimens from Mustang, North Padre, and South Padre Islands. Specimen records were requested from the counties surrounding each island (from north to south: Nueces, Kleberg, Kenedy, Willacy, and Cameron counties). All specimens reported from each island were included in the annotated list of mammals under *specimens reported*. Locality discrepancies such as incorrect county labels were identified with an asterisk within the *specimens reported* section. In order to validate the identification of specimens, specimens were examined from the American Museum of Natural History, National Museum of Natural History, Padre Island Natural History Museum, and The Museum at Texas Tech University. All examined specimens

from each island were included in the annotated list of mammals under *specimens examined*. For reported and examined specimens, the museum acronym (APPENDIX I) as well as the catalog number was included for each record.

Field Surveys.--From May 2005 to March 2007, standardized and non-standardized sampling techniques were used to document mammals within PAIS. All trapping localities were included in Figure 7. Specific data describing date and locality (county, mile marker or other spatial description, transect UTM, and general transect habitat) were recorded at each sampling location. For each captured animal, transect and individual data (species, sex, reproductive condition, age, and standard body measurements) were collected. A single individual of each species was euthanized using chloroform and prepared as a museum voucher. Individuals found dead in traps were prepared as voucher specimens. All other individuals were released at the capture location after appropriate data were collected. All animals captured were handled in accordance with the guidelines set forth by the American Society of Mammalogists and the New Mexico State University Institutional Animal Care and Use committees. All captured specimens were included in the annotated list of mammals under *specimens captured*.

Standardized trapping occurred within PAIS during the summers of 2005 and 2006 and in the fall of 2006. A total of 20,949 Sherman traps were set on standardized transects within PAIS (14,600 on North Padre Island and 6,349 on islands in the Laguna Madre) accumulating 20,836.5 trapnights (14,531.5 on North Padre Island and 6,295 on islands in the Laguna Madre). Assuming all closed but empty traps were open for half a night, a closed but empty trap accounted for 0.5 trapnights.

Standardized trapping occurred at 24 localities on North Padre Island and was located within the North, Closed, or South Beach divisions. In addition to North Padre Island, 11 small islands were surveyed in the Laguna Madre. Each island was considered a single locality. At each trapping locality on North Padre Island, six transects were placed within the different vegetative zones with the exception of the beach (Figure 6). Vegetation was essentially absent from this zone and any species that utilized beach habitats were likely to be found in the adjacent vegetated foredune. When one or more zones were absent from each locality, the remaining transect(s) were placed within the interior zone as it was the single largest terrestrial zone within PAIS (Ramsey III et al. 2002). Since islands in the Laguna Madre were relatively small and did not contain the same terrestrial features, the six transects were placed within the dominant vegetative features found on each island. Transects consisted of 50 LFA Sherman traps (7.6 x 8.9 x 22.9 cm; H.B. Sherman Traps, Tallahassee, FL), spaced 4 m apart, and placed along the orientation of each zone. Traps were baited each afternoon with a mixture of grain, corn, and molasses. Traps were checked the following morning and closed during daylight hours. Traps were set for 2 consecutive nights accumulating a total of 600 trap-nights per locality.

Because, some mammals are not readily captured using Sherman traps, several targeted techniques were used to document other species of mammals.

Two species of shrews, the least shrew (*Cryptotis parva*) and desert shrew (*Notiosorex crawfordi*), have been documented in southern Texas but have not been reported on Texas barrier islands (Blair 1952, Hice and Schmidly 2002). Both species have been reported in marshes (Frey 2005, Schmidly 2004). In attempts to document either of these species, a total

of 365 pitfall trapnights were accumulated within PAIS. Pitfall traps consisted of one liter food containers which were placed in the ground, flush with the surface. Behaviorally, shrews readily use runways created by other species hispid cotton rats (*Sigmodon hispidus*) and marsh rice rats (*Oryzomys palustris*) as well as other species. In general, five traps were placed about four meters apart on a single runway.

Fifty-five pitfall trapnights were accumulated at Pond A, a permanent freshwater pond immediately south of Bird Island Basin road (Figure 5; USA: Texas; Kleberg County, 13.5 Km N, 15.00 Km E El Martillo, UTM 14-3039331N-6685056E). These traps were set at the pond's edge in cattails in addition to emergent wetland vegetation including sedges and forbs. Ten pitfall traps were placed at the shooting range adjacent to the wastewater reclamation ponds west of Malaquite Beach Visitor Center (Figure 5; USA: Texas; Kleberg County, 8.72 Km N, 13.64 Km E El Martillo, UTM 14-3034347N-666836E). These traps were placed in salt grass (*Distichila spicata*). Finally, 300 pitfall trapnights were accumulated in salt grass adjacent to the boat ramp at Bird Island Basing (Figure 5; USA: Texas; Kleberg County, 14.36 Km N, 14.09 Km E El Martillo, UTM 14-3040035N-667067E).

Many species of bats roost in human structures such as buildings (Harris 1988, Kunz et al. 1996). Buildings at the park headquarters, Malaquite Beach Visitor Center, and employee housing within the park were periodically examined for roost sites. Searches were opportunistically conducted within abandoned bunkers and trees were examined when encountered.

In addition to roost searches, mist nets were open for a total of 55.5 hours from 2005-2006. Three, three tiered mist nets of varying lengths (6 m, 9 m, and 12 m) were deployed

after dusk for at least 3 hours over freshwater ponds, within flyways created by willows, and adjacent to manmade structures. Permanent sources of freshwater within PAIS were limited to four ponds and were located at Bird Island Basin (pond A), 0.8 km south of the headquarters building (pond B), and 1.0 km east south east of the Malaquite Beach Visitor Center (pond C and the waste water treatment pond; Figure 5). Mist nets also were deployed in and adjacent to stands of black willow (*Salix nigra*) which occurred sporadically along the Laguna Madre from the northern park boundary south approximately 21 km. Finally, mist nets were deployed adjacent to buildings at headquarters and Malaquite Beach Visitor Center where insects were attracted to lights from buildings and street lamps.

Fossorial species, including gophers (*Geomys personatus*) and moles (*Scalopus aquaticus*), have been previously documented on PAIS. Although evidence of their presence is easily noticed from ground disturbances, individuals were captured using constructed live capture Hart traps which were placed within active burrows or runs (Hart 1973).

In order to document large mammals, two motion sensitive cameras (DeerCam, Park Falls, Wisconsin) were placed along game trails, ponds, and burrows. A total of 214 pictures were taken from 69 camera trap nights. Camera traps were baited with cat food, sardines, or carrion found on the beach. Cameras were used opportunistically to aid in documenting species and were not used to estimate relative abundance. Photo localities were included in APPENDIX II.

Unique microhabitats were sampled opportunistically using Sherman and Tomahawk traps to maximize the likelihood of capturing species in habitats not trapped using standardized techniques. This was also done opportunistically and occurred in areas where mammal sign

was present or where unique habitat patches existed. A total of 11,292 Sherman traps were set on non-standardized transects accumulating a total of 11,274.5 trapnights. A total of 171 Tomahawk traps were set accumulating the same number of trapnights

All mammals that were encountered opportunistically were documented. Additionally, all sign was noted at each sampling locality to document a species presence. Tracks and scat were photographed to provide evidence of species identification. All specimens observed but not captured (including those in photographs) were included in the annotated list of mammals under *Observational Localities*.

Annotated List of Mammals.--All reported or documented species were included in the annotated list of mammals. All species were classified into one of six standard groups used by the National Park Service's Inventory and Monitoring Program. These groups included *present*- species' occurrence in park is documented and assumed to be extant, *probably present*- very high confidence that the organism is currently in the park, *encroaching*- species not documented within PAIS but documented in neighboring areas of Mustang, North Padre, and South Padre islands as well as areas along the adjacent mainland, *historical*- historical occurrence but species is now probably absent, *unconfirmed*- species' occurrence based on weak or no evidence, and *false report*- species previously reported within PAIS based on a misidentification. All scientific names follow Wilson and Reeder (2005).

RESULTS

Based on literature searches, museum queries, and field surveys, 62 non-marine mammal species were reported or documented from Mustang, North Padre, and South Padre islands. Thirty-four of these species were reported or documented from within PAIS. A complete checklist of the non-marine mammals known from Padre Island is included in APPENDIX III. The mammal fauna on Mustang, North Padre, and South Padre islands has been surprisingly well documented in the literature, with a time series dating back well over 100 years. In all, 54 species were reported through literature searches, 18 of which were documented by no other means and 2 were false reports. Twenty-four species were reported from museums. Two species, *Oryzomys couesi* and *Peromyscus maniculatus*, were documented by no other means.

Twenty-five species were documented within PAIS through field surveys during this study. Two additional species, the Virginia opossum (*Didelphis virginiana*) and the fox squirrel (*Sciurus niger*) were documented on North Padre Island outside PAIS. One species, the nutria (*Myocastor coypus*) was documented on Mustang Island. The fox squirrel represents the first record of this species on North Padre Island. On Texas barrier islands, this species was only previously documented on Galveston Island (Hice and Schmidly 2002).

A total of 315 individuals representing eight rodent species were documented on standardized transects on North Padre Island for a total trap success (number of individuals captured per 100 trap nights) of 2.17%. These species include the spotted ground squirrel (*Spermophilus spilosoma*, $n = 6$), Gulf Coast kangaroo rat (*Dipodomys compactus*, $n = 152$), northern pygmy mouse (*Baiomys taylori*, $n = 19$), fulvous harvest mouse (*Reithrodontomys*

fulvescens, $n = 19$), northern grasshopper mouse (*Onychomys leucogaster*, $n = 14$), marsh rice rat (*Oryzomys palustris*, $n = 4$), hispid cotton rat (*Sigmodon hispidus*, $n = 93$), and house mouse (*Mus musculus*, $n = 8$).

No shrews or other mammals were captured using pitfall traps.

No bats were captured from any locality (Table 1). A single unidentified bat was observed flying over the dunes at mile marker 30 on 8 July 2005. Multiple unidentified bats were also seen flying adjacent to the residence facilities just south of the visitor center on 12, 20, 23, and 25 September 2006. A pair of Brazilian free-tailed bats was seen flying adjacent to the Malaquite Beach Visitor Center pavilion on 28 October 2006.

Gophers (*Geomys personatus*) and moles (*Scalopus aquaticus*) were documented primarily by sign; however, a single gopher (*Geomys personatus*) was captured in a Hart trap on the foredune of beach mile 5.5. A single mole was captured by hand crossing the road 1.53 km north by road of the park headquarters.

Two species were documented using motion cameras: the coyote (*Canis latrans*) and northern raccoon (*Procyon lotor*). Of the 214 photos taken, 91 were of coyotes and 14 were of raccoons. The remaining 109 photos were vegetation ($n = 45$), over exposed ($n = 25$), human disturbances ($n = 22$), and unknown ($n = 17$).

A total of 117 individuals were captured from non-standardized Sherman trapping on North Padre Island. When compared to standardized transects, no additional species were captured using Sherman traps through non-standardized trapping. The northern grasshopper mouse (*Onychomys leucogaster*) was the only species captured on standardized transects that was not captured on non-standardized transects. Ten individuals representing two species,

the black rat (*Rattus rattus*) and raccoon (*Procyon lotor*), were captured in Tomahawk traps on non-standardized transects. Six *R. rattus* were captured in Tomahawk traps at the Mansfield Channel jetty which was the only place this species was found. Four *P. lotor* were captured, two at the Mansfield Channel jetty, one at Yarborough Pass, and one at the Shooting Range west of Malaquite Beach Visitor Center. On small islands in the Laguna Madre a total of 255 individuals were captured, which included the marsh rice rat and hispid cotton rat (Table 2). The overall trap success on small islands in the Laguna Madre was 3.16%. Five additional species were documented on small islands through observations and included the Texas pocket gopher, gray fox, coyote, northern raccoon, and white-tailed deer (Table 2).

Based on my field observations as well as others, nineteen species were documented. These species included cow (*Bos taurus*), nilgai (*Boselaphus tragocamelus*), coyote (*Canis latrans*), nine-banded armadillo (*Dasypus novemcinctus*), Gulf Coast kangaroo rat (*Dipodomys compactus*), Texas pocket gopher (*Geomys personatus*), black-tailed jackrabbit (*Lepus californicus*), bobcat (*Lynx rufus*), white-tailed deer (*Odocoileus virginianus*), muskrat (*Ondatra zibethicus*), collared peccary (*Pecari tajacu*), northern raccoon (*Procyon lotor*), roof rat (*Rattus rattus*), eastern mole (*Scalopus aquaticus*), spotted ground squirrel (*Spermophilus spilosoma*), eastern cottontail (*Sylvilagus floridanus*), white-nosed coati (*Nasua narica*), American badger (*Taxidea taxus*), and gray fox. On two occasions, a skunk was smelled but species identification could not be made. The Texas pocket gopher, gray fox, coyote, northern raccoon, and white tailed deer also were documented from small islands in the Laguna Madre (Table 2). From these, 11 species were not documented by any other means.

Annotated List of the Mammals of Padre Island National Seashore, Texas

Present and Probably Present

ORDER DIDELPHIMORPHIA

Family Didelphidae

Didelphis virginiana

Virginia Opossum

The Virginia opossum occurs from southern Ontario and the eastern United States through Central America (Gardner 1982). It ranges throughout Texas except for arid regions in the western part of the state (Bailey 1905, Mearns 1907, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Lloyd (1891) was the first to report it from the northern end Padre Island. Baker and Rabalais (1978) reported it from residential areas of North Padre Island, and Harris (1988) reported it from within PAIS at the Malaquite Beach Visitor Center.

I did not document opossums within PAIS. However, I found three road-killed opossums in urban areas on North Padre Island, Nueces County. In addition, I received a report from a PAIS employee that a dog killed an opossum in a residential area on North Padre Island. Crooks (2002) reported opossums in greatest relative abundance near urban edges, and suggested that this resource generalist benefited from supplemental food resources associated with residential developments. Although I did not document it within PAIS, opossums are probably present in low abundance at the north end of PAIS adjacent to areas of heavy human activity.

Specimens Reported (2). USA: Texas; Mustang Island, 1.7 Mi. Southwest Port Aransas (MSB 57405); USA: Texas; Mustang Island, 6 Mi Southwest Port Aransas (MSB 57404).

Specimens Examined (0).

Observational Localities (3). USA: Texas; Nueces Co, Padre Island, 5.25 Miles South, 3.96

Miles East Flour Bluff, 14R-675420N-3053574E (1); USA: Texas; Nueces Co, 5.60

Miles South, 3.94 Miles East Flour Bluff, 14R-675399N-3053001E (1); USA: Texas;

Nueces Co, Padre Island, 14R-675386N-3052947E (1)

Captures (0).

ORDER CINGULATA

Family Dasypodidae

Dasypus novemcinctus

Nine-banded Armadillo

Audubon and Bachman (1854) reported the first record of the nine-banded armadillo in the United States along the shore of the Rio Grande River in southern Texas. It subsequently expanded its range along the Gulf Coast to Corpus Christi by 1880 (Bailey 1905, Humphrey 1974). It spread throughout much of Texas during the 20th century and it is currently absent only from desert areas of western Texas (Blair 1952, McCarley 1959, Dalquest 1968, Humphrey 1974, Schmidly 2004). Bailey (1905) reported armadillos on Padre Island based on second hand observations. Baker and Rabalais (1978) reported it within PAIS at the Malaquite Beach Campground, and Harris (1988) reported it north of PAIS near the Nueces-Kleberg county line on North Padre Island. I only documented this species south of beach mile 55 (APPENDIX IV). I commonly saw tracks along the Mansfield Channel where I also observed an individual walking along the waters edge.

Over the last century nine-banded armadillos have dramatically expanded their range north and east (Price and Gunter 1943). Possible reasons for this expansion include climate change, overgrazing, and removal of carnivores (Fitch et al. 1952, Talmage and Buchanan 1954). On North Padre Island, however, the range of armadillos appears to have receded, because it is now apparently restricted to the southern half of the island (APPENDIX IV; D. Echols pers. com., L. Moorehead pers. com.). Several factors may be responsible for this change. Livestock husbandry practices involving predator control have occurred extensively throughout Texas (Wade et al. 1984). During the 150 years that ranching occurred on Padre Island, ranchers are likely to have killed predators. Nine-banded armadillos may have benefited from reduced predator populations (Fitch et al. 1954). With the establishment of PAIS in 1964, and with the end of ranching operations in 1971, coyotes and other predators of armadillos are likely to have increased in number, therefore reducing armadillo numbers.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (4).—USA: Texas; Kenedy County, 32.00 Km South, 47.84 Km East

Armstrong, UTM 14-2946869N-668642E (1); USA: Texas; Willacy County, 1.34 Km

North, 10.88 Km East Port Mansfield, UTM 14-2939571N-667838E (1); USA: Texas;

Willacy County, 1.12 Km North, 11.65 Km East Port Mansfield, UTM 14-2939311N-

668592E (1); USA: Texas; Willacy County, 1.02 Km North, 13.09 Km East Port

Mansfield, UTM 14-2939303N-670043E (1)

Captures (0).

ORDER RODENTIA

Family Sciuridae

Spermophilus spilosoma

Spotted Ground Squirrel

The spotted ground squirrel occurs in a narrow band from southern South Dakota, through the central and southwestern United States, into Mexico (Hall 1981, Tomich 1982). In Texas, it ranges throughout much of the western and southern part of the state (Bailey 1905, Mearns 1907, Blair 1952, Dalquest 1968, Schmidly 2004). Merriam (1893) described the subspecies *S. s. annectens* from Padre Island. It has been documented from Padre Island, North Padre Island, and PAIS (Allen 1894, Bailey 1905, Baker and Lay 1938, Howell 1938, Blair 1952, Raun 1959, Koepke 1969, Smith 1973, Yzaguirre 1974, Baccus et al. 1977, Baker and Rabalais 1978, Segers and Chapman 1984, Harris 1988).

Within PAIS, I observed spotted ground squirrels in partially vegetated areas, especially in foredunes and primary dunes (APPENDIX V). For example, I observed them in abundance at the Malaquite Beach Visitor Center, the employee housing just south of the visitor center parking area, and in dunes near the Mansfield Channel jetty. I captured spotted ground squirrels on transects associated with high bare ground intermixed with drafty (i.e. well ventilated) vegetation. Dominant vegetative species included partridge pea (*Chamaecrista fasciculata*), plains wild indigo (*Baptisia leucophaea*), beach tea (*Croton punctatus*), camphor daisy (*Machaeranthera phyllocephala*), Indian blanket (*Gaillardia pulchella*), and other forbs which is consistent with previous descriptions of habitat for this species (Raun 1959, Koepke 1969, Baccus et al. 1977, Baker and Rabalais 1978, Segers and Chapman 1984, Harris 1988).

I captured few individuals which is likely a result of their diurnal activity patterns. It is likely, however, that it occurs wherever sparse vegetation is present.

Specimens Reported (96). USA: Texas; Nueces County, Mustang Island (KU 80428); USA: Texas; Nueces County, Mustang Island, Port Aransas (TTU 90812); *USA: Texas; San Patricio County, Port Aransas (TTU 19831); *USA: Texas; San Patricio County, Port Aransas, City Limits (TTU 11437); USA: Texas; Nueces County, Port Aransas Park (TCWC 50420); USA: Texas; Nueces County, Nueces County Park (TCWC 50413, 50414, 50415, 50416, 50417, 50418); USA: Texas; Mustang Island, 1.7 Mi SW Port Aransas (MSB 57450, 57451, 57452, 57453, 57454, 57455, 57456, 57460); *USA: Texas; San Patricio County, Mustang Island, 5 Mi S Port Aransas (TTU 19832, 19833, 19834, 19835, 19836, 19837, 19838, 19839, 19840); USA: Texas, Mustang Island, 6 Mi SW Port Aransas (MSB 57457, 57458, 57459); USA: Texas; Nueces County, Mustang Island, 7 Mi S, 4 Mi W Port Aransas (TTU 25834, 25835, 25836, 25837, 25838, 25839, 25840, 25841, 25842, 25843, 25844); *USA: Texas; San Patricio County, 9 Mi S Port Aransas (TTU 31661); USA: Texas; Nueces County, Mustang Island, 10 Mi SW Port Aransas (TTU 90811); USA: Texas; Nueces County, Mustang Island, 13 Mi S of Port Aransas (KU 74377, 74382); *USA: Texas; Nueces County, Padre Island, 13 Mi S of Port Aransas (KU 74378, 74379, 74380, 74381); *USA: Texas; San Patricio County, 13 Mi S Port Aransas (TTU 19841, 19842); USA: Texas; Nueces County, Mustang Island, 14 Mi SW of Port Aransas (KU 27136, 27137, 27138, 27139, 27140, 27141, 35138); USA: Texas; Padre Island (NMNH 301945); USA: Texas; Nueces County, Packery Channel Park (TCWC 50419); *USA: Texas; Nueces

County, Mustang Island, 19 Mi S Port Aransas (TCWC 632, 633, 634, 635); USA: Texas; Kleberg County, Padre Island (PSM 9349, 9350, 9351); USA: Texas; Cameron County, Padre Island, 12 Mi from Port Isabel, The Tanks (NMNH 30410); USA: Texas; Cameron County, Padre Island, 6.5 Mi N, 2 Mi E Port Isabel (UIMNH 42800, 42801, 42802, 42803, 42804, 42805, 42806, 42807, 42808, 42809, 42810, 42811, 42812, 42813, 42814, 42815); USA: Texas; Cameron County, Padre Island, 6 Mi N, 3 Mi E Port Isabel (TCWC 27608).

Specimens Examined (13). USA: Texas; Nueces County, Padre Island (NMNH 31436, 31437; TTU 93142); USA: Texas; Cameron County, Padre Island (NMNH 30407, 30408, 30409, 30411, 30412, 30413, 30414, 30415, 30416, A42370).

Observational Localities (7). USA: Texas; Kleberg County, 9.33 Km North, 14.75 Km East El Martillo, UTM 14-3034569N-668125E (1); USA: Texas; Kleberg County, 8.99 Km North, 14.43 Km East El Martillo, UTM 14-3034343N-668008E (1); USA: Texas; Kleberg County, 8.99 Km North, 14.43 Km East El Martillo, UTM 14-3034343N-668008E (1); USA: Texas; Kleberg County, 8.99 Km North, 13.44 Km East El Martillo, UTM 14-3034317N-666885E (1); USA: Texas; Kenedy County, 14.88 Km South, 8.13 Km East El Martillo, UTM 14-3010465N-661972E (1); USA: Texas; Kenedy County, 8.72 Km North, 40.8 Km East Armstrong, UTM 14-2987792N-660813E (1); USA: Texas; Willacy County, 1.30 Km North, 10.88 Km East Port Mansfield, UTM 14-2939568N-667792E (1)

Captures (15). USA: Texas; Kleberg County, 8.99 Km North, 14.43 Km East El Martillo, UTM 14-3034343N-668008E (3); USA: Texas; Kleberg County, 8.32 Km North, 14.06 Km

East El Martillo, UTM 14-3033572N-667445E (1); USA: Texas; Kleberg County, 8.32 Km North, 13.87 Km East El Martillo, UTM 14-3033522N-667531E (1); USA: Texas; Kleberg County, 8.03 Km North, 14.19 Km East El Martillo, UTM 14-3033396N-667637E (4); USA: Texas; Kleberg County, 7.76 Km North, 14.27 Km East El Martillo, UTM 14-3033317N-667779E (2); USA: Texas; Kleberg County, 7.84 Km North, 14.35 Km East El Martillo, UTM 14-3033245N-667744E (1); USA: Texas; Willacy County, 40.00 Km South, 50.56 Km East Armstrong, UTM 14-2939566N-671536E (1); USA: Texas; Willacy County, 6.40 Km North, 14.61 Km East Port Mansfield, UTM 14-2939415N-671619E (2).

Family Geomyidae

Geomys personatus

Texas Pocket Gopher

True (1889) first described the Texas pocket gopher from Padre Island. It is endemic to southern Texas and coastal areas of Tamaulipas, Mexico (Bailey 1905, Blair 1952, Selander et al. 1962, Schmidly 2004). It has been documented from Padre Island, North Padre Island, and PAIS (Allen 1891, Bailey 1905, Baker and Lay 1938, Blair 1952, Raun 1959, Koepke 1969, Baccus et al. 1977, Baker and Rabalais 1978, and Harris 1988). I documented the Texas pocket gopher primarily through sign; no other species of gopher is known to occur on Padre Island. I saw gopher mounds in the greatest density in dune areas, but they were common throughout all terrestrial zones within PAIS (APPENDIX VI). Furthermore, I found a skull on Dredged Material Island 111, but it is possible that it was brought there by a predator.

I also found mounds in Nueces County on North Padre Island in yards, golf courses, and roadsides. It is likely to occur in most habitat types across North Padre Island.

Specimens Reported (184). USA: Texas; Nueces County, Mustang Island (LSUMZ 1583, 1584, 1585, 1586; TTU 92313, 92314, 92315, 92316, 92319, 92320, 92321, 92322, 92323, 92324, 92325, 92326, 92327, 92328, 92329, 92330, 92331, 92332, 92333, 92334, 92335, 92336, 92337, 92338, 92339); USA: Texas; Nueces County, Nueces County Park (TCWC 54066, 54067); USA: Texas; Nueces County, Port Aransas (ASNHC 11384, 11385, 11386, 11387, 11388, 11389; TTU 19332, 19333, 19334, 19335, 19336); USA: Texas; Nueces County, Mustang Island, Port Aransas, University of Texas (TTU 9648, 9649, 9650, 9651, 9652, 9653, 9654, 9655, 9656, 9657, 9658, 9659, 9660); USA: Texas; Nueces County, 2.5 Mi S Port Aransas (UIMNH 39580, 39581, 39582, 39583, 39584, 39585, 39586, 39587); *USA: Texas; San Patricio County, Mustang Island, 4.8 Mi S Port Aransas (TTU 4130); USA: Texas; Nueces County, 5 Mi S Port Aransas (ASNHC 11390, 11391); USA: Texas; Nueces County, Mustang Island, 4.5 Mi N access road no 2 on Park Road 53 (TTU 15334, 15335, 15336, 15337, 15338, 15339, 15340, 15341, 15342, 15343); USA: Texas, Mustang Island, 6 Mi SW Port Aransas (MSB 57470, 57471, 57472); USA: Texas; Nueces County, Mustang Island, 7 Mi S, 4 Mi W Port Aransas (TTU 25206, 25207, 25208, 25209, 25210, 25211, 25212, 25213, 25225); *USA: Texas; Kleberg County, Padre Island, 6.1 Mi S Nueces County Park (TTU 15329); USA: Texas; Nueces County, Mustang Island, access road no 2 (TTU 15344, 15345, 15346, 15347, 15348, 15349, 15350, 15351, 15352, 15353, 15354, 15355, 15356, 15357, 15358, 15359, 15360,

15361, 15362, 15363, 15364, 15365); USA: Texas; Nueces County, Mustang Island, 9 Mi S, 5 Mi W Port Aransas (TTU 25214, 25215, 25216, 25217, 25218, 25219, 25220, 25221, 25222, 25223, 25224); USA: Texas; Nueces County, Mustang Island, 14 Mi SW of Port Aransas (KU 27222, 27223, 27224, 27225, 27226); USA: Texas; Nueces, Mustang Island State Park (TCWC 54091, 54092); USA: Texas; Nueces County, Mustang Island, 15 mi SW Port Aransas (TCWC 28013, 28644, 28645, 28646); USA: Texas; Nueces County, Mustang Island, 13 Mi S of Port Aransas (KU 74383); USA: Texas; Nueces County, Padre Island (AMNH 5542; NMNH A43528; TCWC 43633; TTU 92351); USA: Texas; Nueces County, N end Padre Island (TCWC 1499, 1500, 1501, 1502); USA: Texas; Nueces, Padre Island, Packery Channel Park (TCWC 54068, 54069, 54070, 54076, 54077, 54078, 54079, 54080, 54081, 54082, 54083, 54084, 54085, 54086, 54087, 54088, 54089, 54090); *USA: Texas; Mustang Island, 19 Mi S Port Aransas (MVZ 84157, 84158); *USA: Texas; Nueces County, 19 Mi S Port Aransas (TCWC 617, 618, 619); *USA: Texas; Nueces County, Mustang Island, 19 Mi S Port Aransas (TCWC 614, 615, 616); *USA: Texas; Nueces County, Mustang Island, 23 Mi S Port Aransas (TCWC 811); USA: Texas, Nueces County, Padre Island, 14 Mi SE of Corpus Christi (KU 57905, 57906, 57907); *USA: Texas; San Patricio County, Padre Island, jct Park Road 22 and 53 (TTU 53734, 53735, 53736, 53737, 53738); USA: Texas; Willacy County, 4 Mi E Port Mansfield (TTU 7011, 7012, 7013, 7015); USA: Texas; Willacy County, 4 Mi E Port Mansfield fm 547 (TTU 7003); USA: Texas; Cameron County, Padre Island (NMNH 19667, 19668)

Specimens Examined (65). USA: Texas; Nueces County, Mustang Island (TTU 92317, 92318, 92340, 92341); *USA: Texas; Kleberg County, Padre Island, 6.1 Mi S Nueces County Park (TTU 15330, 15331, 15332, 15333); USA: Texas; Nueces County, Padre Island (AMNH 3468, 3469, 3470, 3471, 3472; NMNH 31429, 31549, 31551, 31552, 31553, 31554, 31555, 31556, 31557, 31558, 31661, 31662, 32947; TTU 92344, 92345, 92346, 92347, 92348, 92349, 92350); USA: Texas; Kleberg County, N Padre Island (TTU 92176, 92177, 92178, 92179, 92180, 92181, 92182, 92183, 92184, 92185, 92186, 92187, 92188, 92189, 92190, 92191, 92192, 92193, 92194, 92195, 92196, 92197, 92198, 92199, 92342, 92343); USA: Texas; Willacy County, 4 Mi E Port Mansfield (TTU 7014); USA: Texas; Willacy County, 4 Mi E Port Mansfield fm 547 (TTU 7004, 7005, 7006); USA: Texas; Willacy County, 8 Mi E Port Mansfield (TTU 7391, 7392);

Observational Localities (45). USA: Texas; Kleberg County, 9.98 Km North, 7.06 Km East El Martillo, UTM 14-3042921N-669421E (1); USA: Texas; Kleberg County, 19.36 Km South, 0.67 Km West Flour Bluff, UTM 14-3042915N-669317E (1); USA: Texas; Kleberg County, Dredged Material Island 111, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041719N-666760E (1); USA: Texas; Kleberg County, 13.98 Km North, 16.48 Km East El Martillo, UTM 14-3039362N-669791E (1); USA: Texas; Kleberg County, 13.92 Km North, 16.32 Km East El Martillo, UTM 14-3039314N-669874E (1); USA: Texas; Kleberg County, 13.70 Km North, 13.94 Km East El Martillo, UTM 14-3039266N-667355E (1); USA: Texas; Kleberg County, 9.95 Km North, 11.78 Km East El Martillo, UTM 14-3035242N-665198E (1); USA: Texas;

Kleberg County, 9.95 Km North, 11.74 Km East El Martillo, UTM 14-3035229N-
 665151E (1); USA: Texas; Kleberg County, 9.33 Km North, 14.75 Km East El Martillo,
 UTM 14-3034569N-668125E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17
 Km East El Martillo, UTM 14-3033984N-666680E (1); USA: Texas; Kleberg County,
 7.76 Km North, 14.19 Km East El Martillo, UTM 14-3033324N-667685E (1); USA:
 Texas; Kleberg County, 0.21 Km South, 11.41 Km East El Martillo, UTM 14-
 3024998N-664975E (1); USA: Texas; Kleberg County, 0.34 Km South, 11.42 Km East
 El Martillo, UTM 14-3024954N-665035E (1); USA: Texas; Kleberg County, 0.29 Km
 South, 11.57 Km East El Martillo, UTM 14-3024943N-665142E (1); USA: Texas;
 Kleberg County, 6.82 Km South, 7.68 Km East El Martillo, UTM 14-3018591N-
 661468E (1); USA: Texas; Kleberg County, 6.86 Km South, 7.76 Km East El Martillo,
 UTM 14-3018554N-661533E (1); USA: Texas; Kleberg County, 6.91 Km South, 7.90
 Km East El Martillo, UTM 14-3018489N-661631E (1); USA: Texas; Kenedy County,
 7.28 Km South, 9.66 Km East El Martillo, UTM 14-3017900N-663061E (1); USA:
 Texas; Kenedy County, 7.46 Km South, 9.70 Km East El Martillo, UTM 14-3017864N-
 663231E (1); USA: Texas; Kenedy County, 7.68 Km South, 9.79 Km East El Martillo,
 UTM 14-3017801N-663356E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34
 Km East Port Mansfield, UTM 14-3009404N-659939E (1); USA: Texas; Kenedy
 County, 25.92 Km South, 7.15 Km East El Martillo, UTM 14-2999362N-660902E (1);
 USA: Texas; Kenedy County, 25.92 Km South, 7.15 Km East El Martillo, UTM 14-
 2999359N-660859E (1); USA: Texas; Kenedy County, 25.92 Km South, 7.14 Km East
 El Martillo, UTM 14-2999291N-660843E (1); USA: Texas; Kenedy County, 25.92 Km

South, 7.12 Km East El Martillo, UTM 14-2999256N-660856E (1); USA: Texas; Kenedy County, 25.92 Km South, 7.10 Km East El Martillo, UTM 14-2999191N-660847E (1); USA: Texas; Kenedy County, 26.08 Km South, 7.06 Km East El Martillo, UTM 14-2999121N-660804E (1); USA: Texas; Kenedy County, 54.54 Km North, 4.50 Km East Port Mansfield, UTM 14-2994215N-660504E (1); USA: Texas; Kenedy County, 54.53 Km North, 4.77 Km East Port Mansfield, UTM 14-2994195N-660554E (1); USA: Texas; Kenedy County, 54.53 Km North, 4.61 Km East Port Mansfield, UTM 14-2994175N-660664E (1); USA: Texas; Kenedy County, 54.53 Km North, 4.32 Km East Port Mansfield, UTM 14-2994174N-660690E (1); USA: Texas; Kenedy County, 54.54 Km North, 4.32 Km East Port Mansfield, UTM 14-2994170N-660731E (1); USA: Texas; Kenedy County, 8.48 Km North, 40.32 Km East Armstrong, UTM 14-2987762N-660719E (1); USA: Texas; Kenedy County, 8.46 Km North, 40.64 Km East Armstrong, UTM 14-2987750N-660662E (1); USA: Texas; Kenedy County, 8.32 Km North, 40.16 Km East Armstrong, UTM 14-2987742N-660619E (1); USA: Texas; Kenedy County, 41.12 Km North, 3.47 Km East Port Mansfield, UTM 14-2979451N-659554E (1); USA: Texas; Kenedy County, 40.96 Km North, 3.04 Km East Port Mansfield, UTM 14-2979377N-659521E (1); USA: Texas; Kenedy County, 40.96 Km North, 3.30 Km East Port Mansfield, UTM 14-2979367N-659503E (1); USA: Texas; Kenedy County, 41.12 Km North, 2.90 Km East Port Mansfield, UTM 14-2979362N-659546E (1); USA: Texas; Kenedy County, 41.28 Km North, 2.72 Km East Port Mansfield, UTM 14-2979303N-659531E (1); USA: Texas; Kenedy County, 41.28 Km North, 2.72 Km East Port Mansfield, UTM 14-2979303N-659531E (1); USA: Texas;

Kenedy County, 24.00 Km South, 45.92 Km East Armstrong, UTM 14-2954474N-666465E (1); USA: Texas; Willacy County, 39.52 Km South, 50.40 Km East Armstrong, UTM 14-2939535N-671406E (1); USA: Texas; Willacy County, 39.52 Km South, 49.60 Km East Armstrong, UTM 14-2939414N-670171E (1); USA: Texas; Willacy County, 39.68 Km South, 49.76 Km East Armstrong, UTM 14-2939326N-670719E (1);

Captures (1). USA: Texas; Kleberg County, 0.29 Km South, 11.57 Km East El Martillo, UTM 14-3024943N-665142E (1)

Family Heteromyidae

Dipodomys compactus

Gulf Coast kangaroo rat

True (1889) first described the Gulf Coast kangaroo rat from Padre Island. It is endemic to southern Texas and coastal areas of Tamaulipas, Mexico (Allen 1891, Bailey 1905, Blair 1952, Schmidly and Hendricks 1976, Baumgardner and Schmidly 1981, Schmidly 2004). It has been documented from Padre Island, North Padre Island, and PAIS (Allen 1891, Bailey 1905, Baker and Lay 1938, Setzer 1949, Raun 1959, Koepke 1969, Kennedy et al. 1973, Yzaguirre 1974, Baccus et al. 1977, Baker and Rabalais 1978, Baumgardner and Schmidly 1981, Smith 1986, Harris 1988, Goetz et al. 1999).

I captured this species across the entire length of PAIS (APPENDIX VII). I captured it in habitats with greater proportions of bare ground, which is consistent with previous studies (Blair 1952, Raun 1959, Koepke 1969, Yzaguirre 1974, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988, Goetz et al. 1999). I captured it in greatest relative abundance at the southern end of the island, in dune areas, and areas adjacent to mudflats. This species avoided areas dominated by gulfdune paspalum (*Paspalum monostachyum*) and other areas with dense vegetation (i.e. vegetation that is not readily penetrated by wind) and a closed canopy layer.

The Gulf Coast kangaroo rat has two distinct color phases: ochraceous-buff (i.e., cinnamon) and cartridge-buff (i.e., gray; Setzer 1949). Ratios between the two color types vary considerably among populations on barrier islands (Table 3; Baumgardner and Schmidly 1981). During this study, I found ochraceous to cartridge buff ratios of 4.7:95.3, while

Baumgardner and Schmidly (1981) found ratios of 34.7:65.3. It is unknown whether changes have occurred on other islands or the reason for the apparent change in ratio.

Specimens Reported (232). USA: Texas; Nueces County, Mustang Island (LSUMZ 1500, 1501, 1502, 1503, 1506, 1507, 1508, 1509, 1510, 1511, 1512, 1513, 1514; TCWC 27560; TTU 89284, 89285, 89289, 89290; UIMNH 24308, 24309; UIMNH 43420); USA: Texas; Nueces, Nueces County Park (TCWC 50382, 50383); *USA: Texas; Aransas County, Mustang Island, Port Aransas (TTU 89105, 89106); *USA: Texas; Aransas County, Port Aransas (TTU 88895, 89085, 89098, 89313); *USA: Texas; Aransas County, Port Aransas, Access Road no 1 (TTU 93949); USA: Texas; Nueces County, Mustang Island, 2 Mi W of Port Aransas (KU 80478, 80479); USA: Texas; Nueces County, 2.5 Mi W Port Aransas (TTU 89288); USA: Texas; Nueces County, 1 Mi S Port Aransas (TTU 89287); *USA: Texas; Aransas County, 1 Mi S Port Aransas (TTU 89084); USA: Texas; Mustang Island, 1.7 Mi SW Port Aransas (MSB 57505, 57506); USA: Texas; Nueces County, 2 Mi SW Port Aransas (TTU 89286); USA: Texas; Nueces County, 2.5 Mi S Port Aransas (UIMNH 39630, 39631, 39632, 39633); USA: Texas; Nueces County, Mustang Island, 3 Mi S Port Aransas (TTU 89299); USA: Texas, Mustang Island, 6 Mi SW Port Aransas (MSB 57507, 57508, 57509, 57510, 57511, 57512); USA: Texas; Nueces County, Mustang Island, 7 Mi S, 4 Mi W Port Aransas (TTU 25854, 25855, 25856, 25857, 25858); USA: Texas; Nueces County, 7 Mi S, 5.4 Mi W Port Aransas (TTU 25853); USA: Texas; Nueces County, Mustang Island, 8 Mi S Aransas Pass (LSUMZ 34553); *USA: Texas; Aransas County, Mustang Island, 8 Mi S Port Aransas (TTU 7971); *USA: Texas; San Patricio County, Mustang

Island, 10 Mi S Port Aransas (TTU 4354); USA: Texas; Nueces County, 10.7 Mi S Port
 Aransas (ASNHC 11393, 11458, 11459, 11460); *USA: Texas; Nueces County, Padre
 Island, 13 Mi S Port Aransas (KU 74385, 74386, 74387, 74388, 74389, 74390, 74391,
 74392); USA: Texas; Nueces County, Mustang Island, 14 Mi SW Port Aransas (KU
 27227, 27228, 27229, 27230, 27231, 27232, 27233, 27234, 27235, 27236, 27237,
 27238, 27325, 27326, 27327, 57929, 57930, 57931, 57932, 57933, 57934, 139123,
 139124); USA: Texas; Nueces County, Mustang Island, 15 Mi S of Port Aransas
 (TCWC 27339, 27340); *USA: Texas; Nueces County, Padre Island, 15 Mi S of Port
 Aransas (KU 74384); USA: Texas; Nueces County, Padre Island (TCWC 27561); USA:
 Texas; Nueces, N end Padre Island (TCWC 1503, 1504; UIMNH 52309); *USA:
 Texas; Nueces, Mustang Island, 19 Mi S Port Aransas (TCWC 636, 637, 638, 639,
 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654;
 MVZ 81610, 81611, 81612, 81613, 81614, 81615, 81616, 81617, 81618, 81619);
 *USA: Texas; Nueces, Mustang Island, 23 Mi S Port Aransas (TCWC 810, 879, 1036,
 1037, 1038; UMMZ 81686, 81687); USA: Texas; Nueces County, Padre Island, 14 Mi
 SE of Corpus Christi (KU 57927, 57928); USA: Texas; Willacy County, South Padre
 Island (UWBM 46715, 46716); USA: Texas; Cameron County, South Padre Island
 (TTU 78761); USA: Texas; Cameron County, 11 Mi N, 3 Mi E Port Isabel (ASNHC
 4321, 5416); USA: Texas; Cameron County, South Padre Island, 3 Mi N Kind Edward
 Atwood Park (TTU 78765); USA: Texas; Cameron County, 10 Mi N, 3 Mi E Port Isabel
 (ASNHC 4322); USA: Texas; Cameron County, 8 Mi N South Padre Island (ASNHC
 9743); USA: Texas; Cameron County, 7.5 Mi N, 3 Mi E Port Isabel (ASNHC 4323,

4324, 4325, 4326); USA: Texas; Cameron County, Padre Island, 6.5 Mi N, 2 Mi E Port Isabel (UIMNH 42839, 42840, 42841, 42842, 42843); USA: Texas; Cameron, Padre Island, 6 Mi N, 2 Mi E Port Isabel (UIMNH 42844, 42845, 42846, 42847, 42848, 42849, 42850, 42851, 42852, 42853, 42854, 42855, 42856, 42857, 42858, 42859); USA: Texas; Cameron, Padre Island, 6 Mi N, 3 Mi E Port Isabel (TCWC 27562, 27563, 27564, 27565, 27566, 27567, 27568, 27569, 27570, 27571, 27572, 27573, 27574, 27575, 27576, 27577, 27578, 27579, 27580, 27581, 27582, 27583, 27584, 27585, 27586, 27587, 29052); USA: Texas; Cameron County, 4.5 Mi N, 3.6 Mi E Port Isabel (ASNHC 4327); USA: Texas; Cameron County, 4.5 Mi N, 3 Mi E Port Isabel (ASNHC 4328); USA: Texas; Cameron County, Padre Island, 4 Mi NE Port Isabel (UIMNH 39626, 39627, 39628, 39629); USA: Texas; Cameron, Padre Island, 3 Mi N, 2 Mi E Port Isabel (UIMNH 42860, 42861, 42862, 42863, 42864, 42865, 42866, 42867, 42868, 42869, 42870, 42871, 42872, 42873, 42874, 42875, 42876, 42877, 42878, 42879, 42880, 42881, 42882, 42883, 42884, 42885, 42886, 42887);

Specimens Examined (46). USA: Texas; Nueces County, Port Aransas (TTU 89297, 89298); USA: Texas; Padre Island (NMNH 16442, 19420, 19421); USA: Texas; Nueces County, Padre Island (AMNH 3475, 3476, 3477, 4137; TTU 88893, TTU 89296; NMNH 31438, 31439, 31440, 31441, 31442, 31443, 31444, 31445, 31544, 31545, 31546, 31547, 31548, 31666, 31667, 32948, A42371, A43529, A43530); USA: Texas; Nueces County, Padre Island oak dune are south of Causeway on NW tip of Island (PAISNHM 486, 487); USA: Texas; Nueces County, Padre Island, 10 Mi SE Flour Bluff (TTU 89300); USA: Texas; Willacy County, Padre Island fore dunes N Side Mansfield

Channel (PAISNHM 488); USA: Texas; Cameron County, Padre Island (NMNH 19665, 30393, 30394, 30395, 30396, 30397, 30398, 30399, 30400); USA: Texas; Cameron County, South Padre Island (TTU 78762, 78763, 78764);

Observational Localities (5). USA: Texas; Kleberg County, 8.32 Km North, 13.87 Km East El Martillo, UTM 14-3033522N-667531E (1); USA: Texas; Kleberg County, 8.03 Km North, 14.19 Km East El Martillo, UTM 14-3033396N-667637E (1); USA: Texas; Kenedy County, 25.92 Km South, 7.15 Km East El Martillo, UTM 14-2999362N-660902E (1); USA: Texas; Kenedy County, 8.72 Km North, 40.8 Km East Armstrong, UTM 14-2987792N-660813E (1); USA: Texas; Kenedy County, 8.58 Km North, 40.64 Km East Armstrong, UTM 14-2987789N-660781E (1)

Captures (172). USA: Texas; Kleberg County, 9.98 Km North, 7.06 Km East El Martillo, UTM 14-3042921N-669421E (1); USA: Texas; Kleberg County, 19.20 Km South, 0.64 Km West Flour Bluff, UTM 14-3042858N-669129E (2); USA: Texas; Kleberg County, 19.20 Km South, 0.99 Km West Flour Bluff, UTM 14-3042829N-668900E (1); USA: Texas; Kleberg County, 13.92 Km North, 16.32 Km East El Martillo, UTM 14-3039314N-669874E (1); USA: Texas; Kleberg County, 13.82 Km North, 16.64 Km East El Martillo, UTM 14-3039288N-669916E (1); USA: Texas; Kleberg County, 13.86 Km North, 16.64 Km East El Martillo, UTM 14-3039230N-669961E (4); USA: Texas; Kleberg County, 13.70 Km North, 16.64 Km East El Martillo, UTM 14-3039219N-669996E (10); USA: Texas; Kleberg County, 9.95 Km North, 11.78 Km East El Martillo, UTM 14-3035242N-665198E (3); USA: Texas; Kleberg County, 9.33 Km North, 14.75 Km East El Martillo, UTM 14-3034569N-668125E (1); USA: Texas;

Kleberg County, 8.32 Km North, 13.87 Km East El Martillo, UTM 14-3033522N-
 667531E (1); USA: Texas; Kleberg County, 8.03 Km North, 14.19 Km East El Martillo,
 UTM 14-3033396N-667637E (6); USA: Texas; Kleberg County, 7.76 Km North, 14.27
 Km East El Martillo, UTM 14-3033317N-667779E (1); USA: Texas; Kleberg County,
 0.17 Km South, 11.54 Km East El Martillo, UTM 14-3024953N-665096E (2); USA:
 Texas; Kleberg County, 0.30 Km North, 11.57 Km East El Martillo, UTM 14-3024943N-
 665147E (2); USA: Texas; Kleberg County, 0.29 Km South, 11.57 Km East El Martillo,
 UTM 14-3024943N-665142E (4); USA: Texas; Kenedy County, 7.28 Km South, 9.12
 Km East El Martillo, UTM 14-3017803N-663371E (5); USA: Texas; Kenedy County,
 25.92 Km South, 7.15 Km East El Martillo, UTM 14-2999362N-660902E (1); USA:
 Texas; Kenedy County, 54.53 Km North, 4.82 Km East Port Mansfield, UTM 14-
 2994167N-660740E (10); USA: Texas; Kenedy County, 6.64 Km South, 42.19 Km
 East Armstrong, UTM 14-2971618N-662601E (2); USA: Texas; Kenedy County, 6.64
 Km South, 42.19 Km East Armstrong, UTM 14-2971614N-662587E (4); USA: Texas;
 Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965519N-
 663933E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East
 Armstrong, UTM 14-2965509N-663685E (2); USA: Texas; Kenedy County, 12.86 Km
 South, 43.42 Km East Armstrong, UTM 14-2965506N-663861E (1); USA: Texas;
 Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965486N-
 663673E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port
 Mansfield, UTM 14-2963896N-662426E (1); USA: Texas; Kenedy County, 25.44 Km
 North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (1); USA: Texas;

Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (4); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 25.44 Km North, 4.48 Km East Port Mansfield, UTM 14-2963600N-661019E (2); USA: Texas; Kenedy County, 25.28 Km North, 4.56 Km East Port Mansfield, UTM 14-2963556N-661225E (2); USA: Texas; Kenedy County, 25.12 Km North, 4.96 Km East Port Mansfield, UTM 14-2963501N-661511E (4); USA: Texas; Kenedy County, 25.28 Km North, 4.96 Km East Port Mansfield, UTM 14-2963489N-661303E (1); USA: Texas; Kenedy County, 24.80 Km South, 47.84 Km East Armstrong, UTM 14-2954558N-666777E (7); USA: Texas; Kenedy County, 24.96 Km South, 47.84 Km East Armstrong, UTM 14-2954511N-666703E (3); USA: Texas; Kenedy County, 24.32 Km South, 45.92 Km East Armstrong, UTM 14-2954488N-666608E (5); USA: Texas; Kenedy County, 13.04 Km North, 9.92 Km East Port Mansfield, UTM 14-2951393N-666774E (8); USA: Texas; Kenedy County, 32.16 Km South, 48.16 Km East Armstrong, UTM 14-2946910N-669039E (4); USA: Texas; Kenedy County, 31.84 Km South, 48.48 Km East Armstrong, UTM 14-2946905N-668979E (4); USA: Texas; Kenedy County, 32.32 Km South, 48.32 Km East Armstrong, UTM 14-2946904N-669048E (3); USA: Texas; Kenedy County, 32.48 Km South, 47.68 Km East Armstrong, UTM 14-2946901N-669014E (3); USA: Texas; Kenedy County, 32.00 Km South, 47.84 Km East Armstrong, UTM 14-2946869N-668642E (3); USA: Texas; Kenedy County, 32.00 Km South, 48.00 Km East Armstrong, UTM 14-2946801N-668528E (7); USA: Texas; Willacy County, 39.04 Km South, 48.80 Km East

Armstrong, UTM 14-2939610N-669785E (13); USA: Texas; Willacy County, 1.32 Km North, 10.85 Km East Port Mansfield, UTM 14-2939588N-667784E (7); USA: Texas; Willacy County, 1.39 Km North, 10.88 Km East Port Mansfield, UTM 14-2939578N-667814E (1); USA: Texas; Willacy County, 1.34 Km North, 10.88 Km East Port Mansfield, UTM 14-2939571N-667838E (3); USA: Texas; Willacy County, 40.00 Km South, 50.56 Km East Armstrong, UTM 14-2939566N-671536E (1); USA: Texas; Willacy County, 1.04 Km North, 11.58 Km East Port Mansfield, UTM 14-2939555N-668389E (9); USA: Texas; Willacy County, 1.13 Km North, 11.02 Km East Port Mansfield, UTM 14-2939541N-667869E (4); USA: Texas; Willacy County, 1.12 Km North, 10.94 Km East Port Mansfield, UTM 14-2939533N-667890E (2); USA: Texas; Willacy County, 1.12 Km North, 11.65 Km East Port Mansfield, UTM 14-2939311N-668592E (2)

Family Cricetidae

Baiomys taylori

Northern Pygmy Mouse

The northern pygmy mouse occurs from the southwestern United States into southern Mexico (Hall 1981). Within Texas, it is only absent from the eastern and western edges of the state, although it is thought to be expanding its range west and north (Bailey 1905, Mearns 1907, Blair 1952, McCarley 1959, Packard 1960, Stangl and Dalquest 1986, Hollander et al. 1987, Schmidly 2004). It has been reported from the northern ends of both North Padre Island and PAIS (Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988, Goetze et al. 1999).

I captured this species in low abundance (1-3 captures per 100 trapnights) across the length PAIS (APPENDIX VIII). In general, I captured it on transects with deep litter layers typically in areas dominated by bushy blue stem (*Andropogon glomeratus*), seacoast bluestem (*Schizachyriu scoparium*), gulfdune paspalum (*Paspalum monostachyum*), and bulrush (*Schoenoplectus americanus*), which is consistent with findings of previous studies (Blair 1952, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988, Goetz et al. 1999). During this study, it was common on transects with a continuous closed canopy and no bare ground, and it is likely to occur wherever dense grass cover exists. Stickel and Stickel (1949) and Jones et al. (2003) found it to be sensitive to reductions in grass cover as a result of cattle grazing. Since Padre Island was under grazing pressure approximately 80 years before the first small mammals surveys, it is not surprising northern pygmy mice were not documented until after the removal of cattle.

Specimens Reported (15). USA: Texas; Nueces County, 2.5 Mi S Port Aransas (UIMNH 40436, 40437); USA: Texas; Mustang Island, 6 Mi SW Port Aransas (MSB 57514, 57515, 57516, 57517, 57518, 57519, 57520, 57521, 57522, 57523, 57524, 57525, 57526);

Specimens Examined (1). USA: Texas; Nueces County, Padre Island grassland SW corner Nueces County Park (PAISNHM 477)

Observational Localities (0).

Captures (30). USA: Texas; Kleberg County, 6.82 Km South, 7.68 Km East El Martillo, UTM 14-3018591N-661468E (2); USA: Texas; Kleberg County, 6.91 Km South, 7.90 Km East El Martillo, UTM 14-3018489N-661631E (1); USA: Texas; Kenedy County, 9.02

Km South, 8.67 Km East El Martillo, UTM 14-3016460N-662730E (3); USA: Texas; Kenedy County, 9.73 Km South, 6.96 Km East El Martillo, UTM 14-3015351N-660695E (2); USA: Texas; Kenedy County, 15.01 Km South, 7.33 Km East El Martillo, UTM 14-3010013N-661083E (3); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009361N-659926E (1); USA: Texas; Kenedy County, 8.32 Km North, 40.16 Km East Armstrong, UTM 14-2987742N-660619E (1); USA: Texas; Kenedy County, 6.56 Km South, 41.70 Km East Armstrong, UTM 14-2971757N-661942E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965551N-663765E (2); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (2); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 24.64 Km South, 45.6 Km East Armstrong, UTM 14-2954426N-666211E (1); USA: Texas; Kenedy County, 24.16 Km South, 45.6 Km East Armstrong, UTM 14-2954375N-666332E (2); USA: Texas; Kenedy County, 13.25 Km North, 10.22 Km East Port Mansfield, UTM 14-2951565N-666931E (3); USA: Texas; Kenedy County, 13.26 Km North, 10.08 Km East Port Mansfield, UTM 14-2951505N-666891E (2); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1); USA: Texas; Willacy County, 39.52 Km South, 50.40 Km East Armstrong, UTM 14-2939535N-671406E (2)

Reithrodontomys fulvescens

Fulvous Harvest Mouse

The fulvous harvest mouse ranges from the central United States through Central America (Hooper 1952). Within Texas, it occurs throughout the eastern two-thirds of the state and is only absent from the Edwards Plateau, western Texas, and portions of the Panhandle (Bailey 1905, Mearns 1907, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). It has been reported from Padre Island, North Padre Island, and PAIS (Bailey 1905, Howell 1914, Raun 1959, Baccus et al. 1977, Baker and Rabalais 1978, Goetze et al. 1999).

I captured fulvous harvest mice in low abundance (1-3 captures per 100 trapnights) across the length PAIS (APPENDIX IX). In general, I found it in areas with dense vegetation, deep litter layers, and a continuous canopy, which is consistent with previous studies (Blair 1952, Raun 1959, Baccus et al. 1977, Baker and Rabalais 1978, Goetz et al. 1999). During this study, it was common in areas dominated by bushy blue stem (*Andropogon glomeratus*), seacoast bluestem (*Schizachyriu scoparium*), and gulfdune paspalum (*Paspalum monostachyum*). It is likely to be found within PAIS wherever dense grass cover occurs.

As with the northern pygmy mouse, Gust and Schmidly (1986) and Jones et al. (2003) reported negative impacts on population densities of the fulvous harvest mouse as a result of cattle grazing. Although ranching occurred on Padre Island from 1804-1971, the fulvous harvest mouse was documented during this time period despite any adverse effects due to cattle (Bailey 1905, Howell 1914, Blair 1952). Jones et al. (2003) indicated that the fulvous harvest mouse was more tolerant of grazed areas than the northern pygmy mouse. This at

least partially explains why the fulvous harvest mouse was documented during the era of cattle grazing within PAIS while the northern pygmy mouse was not.

Specimens Reported (10). USA: Texas; Nueces County, Mustang Island, Port Aransas (TTU 91662); USA: Texas; Nueces County, 2 Mi S Port Aransas (UIMNH 39790, 39791); *USA: Texas; San Patricio County, Mustang Island, 10 Mi S Port Aransas (TTU 4981); USA: Texas; Nueces County, Mustang Island, 10.7 Mi SW Port Aransas (ASNHC 11438, 11631, 11632, 11633, 11634, 11635);

Specimens Examined (5). USA: Texas; Nueces County, Padre Island (NMNH 19666); USA: Texas; Nueces County, Padre Island, oak dune area south of Causeway on NW tip of Island (PAISNHM 478); USA: Texas; Nueces County, Padre Island, grassland adjacent to Nueces County Park no 2 (PAISNHM 475); USA: Texas; Nueces County, Padre Island, oak dune area of Nueces County Park no 2 (PAISNHM 476, 479)

Observational Localities (0).

Captures (27). USA: Texas; Kleberg County, 13.98 Km North, 16.48 Km East El Martillo, UTM 14-3039362N-669791E (1); USA: Texas; Kleberg County, 13.39 Km North, 13.97 Km East El Martillo, UTM 14-3038709N-667555E (1); USA: Texas; Kleberg County, 8.03 Km North, 14.19 Km East El Martillo, UTM 14-3033396N-667637E (1); USA: Texas; Kleberg County, 7.06 Km South, 8.06 Km East El Martillo, UTM 14-3018371N-661781E (3); USA: Texas; Kenedy County, 8.50 Km South, 8.85 Km East El Martillo, UTM 14-3016602N-662531E (2); USA: Texas; Kenedy County, 9.02 Km South, 8.67 Km East El Martillo, UTM 14-3016460N-662730E (2); USA: Texas; Kenedy County, 15.23 Km South, 7.14 Km East El Martillo, UTM 14-3010089N-660901E (1); USA:

Texas; Kenedy County, 15.01 Km South, 7.33 Km East El Martillo, UTM 14-3010013N-661083E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009404N-659939E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009361N-659926E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009329N-659984E (1); USA: Texas; Kenedy County, 54.72 Km North, 4.32 Km East Port Mansfield, UTM 14-3009272N-660001E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965503N-663617E (1); USA: Texas; Kenedy County, 13.25 Km North, 10.22 Km East Port Mansfield, UTM 14-2951565N-666931E (3); USA: Texas; Kenedy County, 13.26 Km North, 10.08 Km East Port Mansfield, UTM 14-2951505N-666891E (1); USA: Texas; Kenedy County, 13.06 Km North, 10.03 Km East Port Mansfield, UTM 14-2951440N-666828E (1); USA: Texas; Willacy County, 39.52 Km South, 50.40 Km East Armstrong, UTM 14-2939535N-671406E (2); USA: Texas; Willacy County, 1.12 Km North, 12.26 Km East Port Mansfield, UTM 14-2939339N-669191E (1); USA: Texas; Willacy County, 1.02 Km North, 13.09 Km East Port Mansfield, UTM 14-2939303N-670043E (2)

Onychomys leucogaster

Northern Grasshopper Mouse

The northern grasshopper mouse ranges from southern Canada through the western United States to northern Mexico (Hall 1981). Within Texas, it occurs in the western and southern portions of the state (Bailey 1905, Blair 1952, Dalquest 1968, Engstrom and Choate 1979, Schmidly 2004). It has been reported from Padre Island, North Padre Island, and PAIS

(Baker and Lay 1938, Raun 1959, Koepke 1969, Baker and Rabalais 1978, and Hall 1981. Yzaguirre (1974) likely captured this species from PAIS but reported it as the white-footed mouse (see *Peromyscus leucopus* for potential identification problems). I captured this species from the southern end of PAIS on transects with short, sparse vegetation, which included various forbs, shoregrass, and glasswort (*Salicornia sp.*).

During the 20th century, the range of the northern grasshopper mouse appeared to change on Padre Island. Baker and Lay (1938) reported it in abundance on Mustang Island (sic), capturing 12 individuals in 100 trapnights (12.00% trap success). Although Blair (1952) reported it as common on Mustang Island, Koepke (1969) only captured one individual in 1,500 trapnights (0.07% trap success) from similar locations. Yzaguirre (1974) reported 7 individuals in 1,890 trapnights (0.37% trap success) at beach mile 9. Baker and Rabalais (1978) noted the decline in abundance of this species. By 1988, the species was absent from northern portions of PAIS (Harris 1988). The results from this study exemplify this range reduction. I captured 14 individuals in 32,101 trapnights (0.04% trap success), and only from south of beach mile 44 (APPENDIX X).

It is possible that cattle maintained suitable habitat for this species at the northern part of the island by keeping vegetation low. Once cattle were removed in 1971, vegetation growth could have forced this species farther south where less rainfall results in shorter, less dense vegetation. This species is likely to be restricted to southern parts of the island where vegetation is sparser.

Specimens Reported (45). USA: Texas; Nueces County, Mustang Island (LSUMZ 1496, 1497, 1498, 1499); *USA: Texas; Aransas County, Mustang Island, Port Aransas (TTU

92535); USA: Texas; Nueces County, Mustang Island, 2 Mi W Port Aransas (KU 80581); USA: Texas; Nueces County, Mustang Island, 2 Mi SW Port Aransas (TTU 92728, 92729, 92730, 92731); USA: Texas; Nueces County, Mustang Island, 2.5 Mi S Port Aransas (UIMNH 40443, 40444, 40445, 40446, 40447, 40448, 40449); USA: Texas; Nueces County, Mustang Island, 5 Mi SW Port Aransas (TTU 92732); USA: Texas; Mustang Island, 6 Mi SW Port Aransas (MSB 141118); USA: Texas; Nueces County, Mustang Island, 7.8 Mi SE Port Aransas (TTU 92733); *USA: Texas; Aransas County, Mustang Island, 8 Mi S Port Aransas (TTU 7967, 7969); USA: Texas; Nueces County, N end Padre Island (TCWC 1505, 1800, 1801); *USA: Texas; Nueces County, Mustang Island, 19 Mi S Port (TCWC 843, 844, 845, 846); *USA: Texas; Nueces County, Mustang Island, 23 Mi S Port Aransas (TCWC 800, 801; UMMZ 81688, 81689, 81690, 81691); USA: Texas; Cameron County, 11 Mi N, 3 Mi E Port Isabel (ASNHC 4348); USA: Texas; Cameron County, Padre Island, 5 Mi N, 2 Mi E Port Isabel (UIMNH 42939, 42940, 42941, 42942, 42943, 42944); USA: Texas; Cameron County, Padre Island, 4 Mi NE Port Isabel (UIMNH 40450, 40451, 40452);

Specimens Examined (6). USA: Texas; Nueces County, Padre Island, 0.5 Mi E Intracoastal Waterway, flats to left of J.F. Kennedy Causeway (PAISNHM 484, 485); USA: Texas; Willacy County, Padre Island, fore dunes N Side Mansfield Channel (PAISNHM 480, 481, 482, 483)

Observational Localities (0).

Captures (14). USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port Mansfield, UTM 14-2963896N-662426E (3); USA: Texas; Kenedy County, 24.96 Km North, 6.02

Km East Port Mansfield, UTM 14-2963702N-662669E (2); USA: Texas; Willacy County, 39.04 Km South, 48.80 Km East Armstrong, UTM 14-2939610N-669785E (1); USA: Texas; Willacy County, 1.32 Km North, 10.85 Km East Port Mansfield, UTM 14-2939588N-667784E (2); USA: Texas; Willacy County, 1.30 Km North, 10.88 Km East Port Mansfield, UTM 14-2939568N-667792E (1); USA: Texas; Willacy County, 1.13 Km North, 11.02 Km East Port Mansfield, UTM 14-2939541N-667869E (1); USA: Texas; Willacy County, 1.12 Km North, 10.94 Km East Port Mansfield, UTM 14-2939533N-667890E (1); USA: Texas; Willacy County, 39.52 Km South, 49.60 Km East Armstrong, UTM 14-2939414N-670171E (2); USA: Texas; Willacy County, 1.25 Km North, 14.50 Km East Port Mansfield, UTM 14-2939399N-671516E (1)

Oryzomys palustris

Marsh Rice Rat

The marsh rice rat occurs through the mid-Atlantic and southern states, and occurs along coastal regions of Texas (Allen 1891, Bailey 1905, Mearns 1907, Blair 1952, McCarley 1959, Hall 1981). It has been reported on Padre Island, North Padre Island, and PAIS (Bailey 1905, Goldman 1918, Raun 1959, Koepke 1969, Baccus et al. 1977, Baker and Rabalais 1978, Hall 1981). Within PAIS, I documented it on 10 small islands in the Laguna Madre and from five localities on North Padre Island (Table 2, APPENDIX XI).

On small islands in the Laguna Madre, I commonly captured it on transects with dense vegetation that formed a closed canopy. I captured it in areas dominated by various purslanes (Family Aizoaceae), salt grass (*Distichila spicata*), bushy blue stem (*Andropogon glomeratus*), codgrass (*Spartina sp.*), and cattail (*Typha domingensis*). I did not capture it on transects with

woody forbs and other drafty vegetation (i.e. well ventilated), which was common on some islands. I captured the marsh rice rat in greatest relative abundance on North Bird Island (36 individuals in 300 trapnights, 12.00% trap success), which is a low profile islands with standing salt water, dominated by sea purslane (*Sesuvium portulacastrum*) and other species of the purslane family. Raun (1959) also documented this species on small islands in the Laguna Madre.

I found marsh rice rats to be rare on North Padre Island within PAIS. I captured six individuals in the immediate vicinity of standing fresh water. Mesic adapted species such as bulrush (*Scirpus pungens*) dominated the vegetation in these areas, which is consistent with previous literature (Raun 1959, Koepke 1969, Baker and Rabalais 1978, Wolfe 1982). Within PAIS, it is likely restricted to fresh water ponds on North Padre Island and small islands with dense vegetation.

Specimens Reported (121). USA: Texas; Nueces County, Mustang Island, 2 Mi W of Port Aransas (KU 80530, 80531); USA: Texas; Nueces County, 2.5 Mi S Port Aransas (UIMNH 39710, 39711, 39712); USA: Texas; Mustang Island, 6 Mi SW Aransas (MSB 57558, 57559, 57560, 57561, 57562, 57563); USA: Texas; Nueces County, Mustang Island, 7.8 Mi SW Port Aransas (TTU 92734); USA: Texas; Cameron County, 3.6 Mi N, 3 Mi E Port Isabel (ASNHC 2885, 2886, 2887, 2888, 2889, 2890, 2891, 2892, 2893, 2894, 2895, 2896, 2897, 2898, 2899, 2900, 2901, 2902, 2903, 2904, 2905, 2906, 2907, 2908, 2909, 2910, 2911, 2912, 2913, 2914, 2915, 2916, 2917, 2918, 2919, 2920, 2921, 2922, 2923, 2924, 2925, 2926, 2927, 2928, 2929, 2930, 2931, 2932, 2933, 2934, 2935, 2936, 2937, 2938, 2939, 2940, 2941, 2942, 2943, 2944, 2945,

2946, 2947, 2948, 2949, 2950, 2951, 2952, 2953, 2954, 2955, 2956, 2957, 2958,
2959, 2960, 2961, 2962, 2963, 2964, 2965, 2966, 2967, 2968, 2969, 2970, 2971,
2972, 2973, 2974, 2975, 2976, 2977, 2978, 2979, 2980, 2981, 2982, 2983, 2984,
2985, 2988, 2989, 2990, 2991, 2992, 2993, 2994, 2995)

Specimens Examined (5). USA: Texas; Nueces County, Padre Island (NMNH 31540, 31541,
31542, 31543); USA: Texas; Kleberg County, Padre Island, Spoil Island just north and
opposite S Bird Island (PAISNHM 490);

Observational Localities ().

Captures (74). USA: Texas; Kleberg County, 20.16 Km North, 15.44 Km East El Martillo, UTM
14-3045565N-668925E (4); USA: Texas; Kleberg County, 20.00 Km North, 14.99 Km
East El Martillo, UTM 14-3045518N-668316E (3); USA: Texas; Kleberg County, 20.00
Km North, 14.98 Km East El Martillo, UTM 14-3045431N-668329E (1); USA: Texas;
Kleberg County, 19.84 Km North, 15.44 Km East El Martillo, UTM 14-3045375N-
668843E (2); USA: Texas; Kleberg County, 19.84 Km North, 15.36 Km East El
Martillo, UTM 14-3045362N-668824E (3); USA: Texas; Kleberg County, 19.84 Km
North, 15.60 Km East El Martillo, UTM 14-3045304N-668780E (11); USA: Texas;
Kleberg County, 19.84 Km North, 15.63 Km East El Martillo, UTM 14-3045243N-
668778E (7); USA: Texas; Kleberg County, 19.68 Km North, 15.49 Km East El
Martillo, UTM 14-3045209N-668730E (13); USA: Texas; Kleberg County, 19.68 Km
North, 14.93 Km East El Martillo, UTM 14-3045156N-668244E (1); USA: Texas;
Kleberg County, 19.68 Km North, 14.93 Km East El Martillo, UTM 14-3045111N-
668249E (1); USA: Texas; Kleberg County, 19.36 Km North, 14.78 Km East El

Martillo, UTM 14-3044862N-668068E (1); USA: Texas; Kleberg County, 17.34 Km
 South, 0.86 Km West Flour Bluff, UTM 14-3044556N-667997E (2); USA: Texas;
 Kleberg County, 18.02 Km South, 1.23 Km West Flour Bluff, UTM 14-3043721N-
 667474E (4); USA: Texas; Kleberg County, 16.96 Km North, 14.24 Km East El
 Martillo, UTM 14-3042324N-667502E (2); USA: Texas; Kleberg County, 16.64 Km
 North, 13.68 Km East El Martillo, UTM 14-3041930N-667155E (1); USA: Texas;
 Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041775N-
 666579E (1); USA: Texas; Kleberg County, 15.42 Km North, 12.80 Km East El
 Martillo, UTM 14-3040696N-666284E (1); USA: Texas; Kleberg County, 21.76 Km
 South, 3.89 Km West Flour Bluff, UTM 14-3040632N-666104E (1); USA: Texas;
 Kleberg County, 14.58 Km North, 12.99 Km East El Martillo, UTM 14-3039963N-
 666450E (9); USA: Texas; Kleberg County, 12.30 Km North, 15.17 Km East El
 Martillo, UTM 14-3037646N-668636E (1); USA: Texas; Kleberg County, 10.78 Km
 North, 14.34 Km East El Martillo, UTM 14-3036282N-667841E (2); USA: Texas;
 Kleberg County, 8.99 Km North, 13.44 Km East El Martillo, UTM 14-3034317N-
 666885E (1); USA: Texas; Kenedy County, 15.23 Km South, 7.10 Km East El Martillo,
 UTM 14-3010003N-660765E (1); USA: Texas; Kenedy County, 24.64 Km South, 45.6
 Km East Armstrong, UTM 14-2954426N-666211E (1)

Sigmodon hispidus

Hispid Cotton Rat

The hispid cotton rat occurs throughout the central and southern United States and is
 found throughout much of Texas (Allen 1891, Bailey 1905, Mearns 1907, Blair 1952, McCarley

1959, Dalquest 1968, Hall 1981, Schmidly 2004). It has been documented on Padre Island, North Padre Island, and PAIS (Raun 1959, Koepke 1969, Mascarello et al. 1974, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988). I documented it across the length of PAIS as well as on several small islands in the Laguna Madre (Table 2, APPENDIX XII).

During this study, the hispid cotton rat was the most common species captured. I trapped it in a wide variety of habitats, but it was most common in areas with tall, drafty (i.e. well ventilated) vegetation that included woody forbs, cactus, and mesquite found on Dredged Material Islands. I documented it in greatest relative abundance on Dredged Material Island 111 (95 individuals in 300 trapnights, 31.67% trap success). On this island, prickly pear (*Ountia* sp.) covered approximately 23% of the 3.0 ha island. Bailey (1905) described thorny chaparral and cactus as optimal protection for this species. I did not capture this species in areas with dense vegetation such as gulfdune paspalum (*Paspalum monostachyum*), in areas with high proportions of bare ground, or in extremely mesic areas. These results are consistent with previous studies (Blair 1952, Raun 1959, Koepke 1969, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988). It is likely to occur within PAIS wherever drafty cover can be found.

Specimens Reported (80). USA: Texas; Nueces County, Port Aransas (LSUMZ 33078, 33079); USA: Texas; Nueces County, UT Marine Science Institute (ASNHC 12484); USA: Texas; Nueces County, 2.5 Mi S Port Aransas (UIMNH 40487, 40488, 40489, 40490, 40491, 40492, 40493, 40494, 40495, 40496, 40497, 40498, 40499, 40500, 40501, 40502, 40503, 40504, 40505); USA: Texas, Mustang Island, 6 Mi SW Port Aransas (MSB 57610, 57611, 57612, 57613, 57614, 57615, 57616, 57617, 57618,

57619, 57620, 57621, 57622, 57623, 57624); *USA: Texas; Aransas County, 8 Mi S Port Aransas (TTU 7970); USA: Texas; Nueces County, Mustang Island, 10.7 Mi SW Port Aransas (ASNHC 11648, 11649); *USA: Texas; San Patricio County, Mustang Island, 10 Mi S Port Aransas (TTU 4519); USA: Texas; Nueces County, Mustang Island, 14 Mi SW Port Aransas (KU 27267); USA: Texas; Nueces County, 13.9 Mi S, 10.6 Mi E Corpus Christi (ASNHC 7867); USA: Texas; Cameron County, Padre Island, 5 Mi N, 2 Mi E Port Isabel (UIMNH 42948, 42949, 42950, 42951, 42952, 42953, 42954, 42955, 42956, 42957, 42958, 42959); USA: Texas; Cameron County, 4.5 Mi N, 3 Mi E Port Isabel (ASNHC 4515, 4516, 4517, 4518, 4519, 4520); USA: Texas; Cameron County, Padre Island, 4 Mi NE Port Isabel (UIMNH 40506, 40507, 40508, 40509); USA: Texas; Cameron County, 3.6 Mi N, 3 Mi E Port Isabel (ASNHC 4521, 4522, 4523, 4524, 4525, 4526, 4527, 4528, 4529, 4530, 5610, 5611, 7942); USA: Texas; Cameron County, Padre Island, 2 Mi E Port Isabel (UIMNH 42963, 42964)

Specimens Examined (3). USA: Texas; Port Aransas (NMNH 532411); USA: Texas; Nueces County, Padre Island, oak dune area south of Causeway on NW tip of Island (PAISNHM 491); USA: Texas; Nueces County, Padre Island, oak dune area Nueces County Park no 2 (PAISNHM 492)

Observational Localities (0).

Captures (288). USA: Texas; Kleberg County, 19.20 Km South, 0.99 Km West Flour Bluff, UTM 14-3042829N-668900E (3); USA: Texas; Kleberg County, 16.96 Km North, 14.24 Km East El Martillo, UTM 14-3042324N-667502E (1); USA: Texas; Kleberg County,

16.96 Km North, 13.82 Km East El Martillo, UTM 14-3042239N-667323E (7); USA:
 Texas; Kleberg County, 16.70 Km North, 16.18 Km East El Martillo, UTM 14-
 3042056N-669914E (2); USA: Texas; Kleberg County, 16.43 Km North, 13.23 Km
 East El Martillo, UTM 14-3041908N-666653E (4); USA: Texas; Kleberg County, 16.48
 Km North, 13.26 Km East El Martillo, UTM 14-3041852N-666727E (3); USA: Texas;
 Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041831N-
 666664E (6); USA: Texas; Kleberg County, 16.43 Km North, 13.23 Km East El
 Martillo, UTM 14-3041787N-666627E (8); USA: Texas; Kleberg County, 16.43 Km
 North, 13.23 Km East El Martillo, UTM 14-3041779N-666625E (25); USA: Texas;
 Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041775N-
 666579E (3); USA: Texas; Kleberg County, 16.43 Km North, 13.23 Km East El
 Martillo, UTM 14-3041719N-666760E (18); USA: Texas; Kleberg County, 16.43 Km
 North, 13.23 Km East El Martillo, UTM 14-3041719N-666760E (32); USA: Texas;
 Kleberg County, 16.32 Km North, 13.25 Km East El Martillo, UTM 14-3041704N-
 666693E (31); USA: Texas; Kleberg County, 20.48 Km South, 3.31 Km West Flour
 Bluff, UTM 14-3041546N-666546E (9); USA: Texas; Kleberg County, 16.16 Km North,
 13.20 Km East El Martillo, UTM 14-3041512N-666561E (6); USA: Texas; Kleberg
 County, 15.97 Km North, 13.07 Km East El Martillo, UTM 14-3041508N-666535E (6);
 USA: Texas; Kleberg County, 16.16 Km North, 13.25 Km East El Martillo, UTM 14-
 3041478N-666610E (6); USA: Texas; Kleberg County, 15.97 Km North, 13.07 Km
 East El Martillo, UTM 14-3041456N-666521E (2); USA: Texas; Kleberg County, 20.48
 Km South, 3.28 Km West Flour Bluff, UTM 14-3041401N-666586E (8); USA: Texas;

Kleberg County, 15.97 Km North, 13.07 Km East El Martillo, UTM 14-3041392N-666603E (6); USA: Texas; Kleberg County, 20.96 Km South, 3.65 Km West Flour Bluff, UTM 14-3041121N-666358E (2); USA: Texas; Kleberg County, 20.96 Km South, 3.74 Km West Flour Bluff, UTM 14-3041107N-666384E (2); USA: Texas; Kleberg County, 21.76 Km South, 3.89 Km West Flour Bluff, UTM 14-3040564N-666216E (2); USA: Texas; Kleberg County, 13.98 Km North, 14.03 Km East El Martillo, UTM 14-3039313N-667364E (2); USA: Texas; Kleberg County, 13.70 Km North, 13.94 Km East El Martillo, UTM 14-3039266N-667355E (2); USA: Texas; Kleberg County, 13.86 Km North, 13.94 Km East El Martillo, UTM 14-3039212N-667353E (1); USA: Texas; Kleberg County, 13.63 Km North, 13.87 Km East El Martillo, UTM 14-3039040N-667275E (2); USA: Texas; Kleberg County, 12.30 Km North, 15.17 Km East El Martillo, UTM 14-3037646N-668636E (1); USA: Texas; Kleberg County, 9.95 Km North, 11.65 Km East El Martillo, UTM 14-3035241N-665057E (1); USA: Texas; Kleberg County, 9.92 Km North, 11.9 Km East El Martillo, UTM 14-3035211N-665286E (1); USA: Texas; Kleberg County, 8.03 Km North, 14.19 Km East El Martillo, UTM 14-3033396N-667637E (1); USA: Texas; Kenedy County, 7.68 Km South, 9.79 Km East El Martillo, UTM 14-3017801N-663356E (2); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009404N-659939E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009361N-659926E (1); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009360N-660039E (2); USA: Texas; Kenedy County, 54.88 Km North, 4.34 Km East Port Mansfield, UTM 14-3009329N-659984E (1); USA:

Texas; Kenedy County, 54.72 Km North, 4.32 Km East Port Mansfield, UTM 14-3009281N-660035E (9); USA: Texas; Kenedy County, 54.72 Km North, 4.32 Km East Port Mansfield, UTM 14-3009272N-660001E (2); USA: Texas; Kenedy County, 6.56 Km South, 41.70 Km East Armstrong, UTM 14-2971664N-662052E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965503N-663617E (3); USA: Texas; Kenedy County, 25.28 Km North, 4.72 Km East Port Mansfield, UTM 14-2963474N-661343E (2); USA: Texas; Kenedy County, 25.28 Km North, 4.64 Km East Port Mansfield, UTM 14-2963437N-661392E (2); USA: Texas; Kenedy County, 24.80 Km South, 47.84 Km East Armstrong, UTM 14-2954558N-666777E (1); USA: Texas; Kenedy County, 24.16 Km South, 45.6 Km East Armstrong, UTM 14-2954375N-666332E (3); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1); USA: Texas; Willacy County, 39.04 Km South, 48.80 Km East Armstrong, UTM 14-2939610N-669785E (1); USA: Texas; Willacy County, 1.18 Km North, 11.44 Km East Port Mansfield, UTM 14-2939591N-668369E (5); USA: Texas; Willacy County, 1.32 Km North, 10.85 Km East Port Mansfield, UTM 14-2939588N-667784E (1); USA: Texas; Willacy County, 1.39 Km North, 10.88 Km East Port Mansfield, UTM 14-2939578N-667814E (3); USA: Texas; Willacy County, 1.30 Km North, 10.88 Km East Port Mansfield, UTM 14-2939568N-667792E (4); USA: Texas; Willacy County, 40.00 Km South, 50.56 Km East Armstrong, UTM 14-2939566N-671536E (1); USA: Texas; Willacy County, 1.04 Km North, 11.58 Km East Port Mansfield, UTM 14-2939555N-668389E (4); USA: Texas; Willacy County, 1.13 Km North, 11.02 Km East Port Mansfield, UTM 14-2939541N-

667869E (4); USA: Texas; Willacy County, 39.52 Km South, 50.40 Km East
 Armstrong, UTM 14-2939535N-671406E (4); USA: Texas; Willacy County, 1.12 Km
 North, 10.94 Km East Port Mansfield, UTM 14-2939533N-667890E (1); USA: Texas;
 Willacy County, 39.52 Km South, 49.60 Km East Armstrong, UTM 14-2939414N-
 670171E (1); USA: Texas; Willacy County, 1.25 Km North, 14.50 Km East Port
 Mansfield, UTM 14-2939399N-671516E (3); USA: Texas; Willacy County, 1.12 Km
 North, 12.26 Km East Port Mansfield, UTM 14-2939339N-669191E (2); USA: Texas;
 Willacy County, 39.68 Km South, 49.76 Km East Armstrong, UTM 14-2939326N-
 670719E (17); USA: Texas; Willacy County, 1.12 Km North, 11.65 Km East Port
 Mansfield, UTM 14-2939311N-668592E (2); USA: Texas; Willacy County, 1.02 Km
 North, 13.09 Km East Port Mansfield, UTM 14-2939303N-670043E (1)

Family Muridae

Mus musculus

House Mouse

The house mouse is native to Eurasia, but has been introduced worldwide and is present throughout Texas (Bailey 1905, McCarley 1959, Dalquest 1968, Auffray et al. 1990, Schmidly 2004). It has been reported from Padre Island and North Padre Island (Baker and Lay 1938, Raun 1959, Koepke 1969, and Baker and Rabalais 1978. Within PAIS, Harris (1988) reported it from the Malaquite Beach Visitor Center. During this study, it appeared to be uncommon within PAIS. I only documented it at the Turtle Patrol Cabin at beach mile 39.5 and along Mansfield Channel (APPENDIX XIII). I frequently saw fecal droppings presumably of this species in storage areas at the park headquarters, but trapping in these areas was

unsuccessful. Elsewhere, I generally captured it in areas with moderate vegetation height and grass cover, which is consistent with previous studies (Blair 1952, Koepke 1969, Baker and Rabalais 1978, Harris 1988).

Transportation of the house mouse by humans has greatly altered this species distribution, and its presence at the Turtle Patrol Cabin and Mansfield Channel is likely a result of anthropogenic factors (Auffray et al. 1990, Baker 1994). The Turtle Patrol Cabin and the Mansfield Channel jetties are among the most frequently visited sites on South Beach by park staff and visitors. Considering the heavy human use at these localities, it is likely that humans inadvertently transport it down island in camping equipment, vehicles, food containers, and other storage devices. Although it was uncommon during this study, it has a high potential of becoming established in other areas within PAIS as a result of human transport.

Specimens Reported (7). USA: Texas; Nueces County, Mustang Island (TTU 93795); USA:

Texas; Nueces County, Mustang Island, 2 Mi W of Port Aransas (KU 80595); *USA:

Texas; San Patricio County, Mustang Island, 10 Mi S Port Aransas (TTU 4952, 4953);

USA: Texas; Cameron County, South Padre Island (ASNHC 11471, 11472); USA:

Texas; Cameron County, South Padre Island, Coastal Studies Lab (ASNHC 10405);

Specimens Examined (1). USA: Texas; Willacy County, Padre Island, fore dunes N Side

Mansfield Channel (PAISNHM 489);

Observational Localities (0).

Captures (8). USA: Texas; Kenedy County, 6.64 Km South, 42.19 Km East Armstrong, UTM

14-2971612N-662615E (1); USA: Texas; Willacy County, 1.32 Km North, 10.85 Km

East Port Mansfield, UTM 14-2939588N-667784E (1); USA: Texas; Willacy County,

1.30 Km North, 10.88 Km East Port Mansfield, UTM 14-2939568N-667792E (2); USA: Texas; Willacy County, 40.00 Km South, 50.56 Km East Armstrong, UTM 14-2939566N-671536E (2); USA: Texas; Willacy County, 1.13 Km North, 11.02 Km East Port Mansfield, UTM 14-2939541N-667869E (1); USA: Texas; Willacy County, 1.12 Km North, 10.94 Km East Port Mansfield, UTM 14-2939533N-667890E (1)

Rattus rattus

Roof Rat

The roof rat, also known as black rat, is native to Eurasia, but has obtained a worldwide distribution through human-mediated introductions (Courchamp et al. 2003, Russell and Clout 2004). At the beginning of the 20th century, few specimens of roof rat existed from Texas, but this it is now common and found commensally with humans throughout the state (Bailey 1905, Davis 1947, Dalquest 1968, Schmidly 2004). Baker and Rabalais (1978) reported it on North Padre Island around urban areas in Nueces County, Bob Hall Pier, and near the Malaquite Beach Visitor Center within PAIS. I only documented this species at the Mansfield Channel jetty where it was locally abundant. I received a report from a PAIS employee of this species at the Turtle Patrol Cabin at beach mile 39.5 (L. Moorehead pers. com.). Much like the house mouse, humans are likely responsible for transporting roof rats down island. At Mansfield Channel, I observed a rat jump from the undercarriage of a vehicle onto the ground and run to the jetty. This species appears to be restricted to the jetty at Mansfield Channel where it is locally common.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kenedy County, 6.64 Km South, 42.19 Km East
Armstrong, UTM 14-2971612N-662615E (1)

Captures (6). USA: Texas; Willacy County, 1.18 Km North, 14.61 Km East Port Mansfield,
UTM 14-2939400N-671662E (6)

ORDER LAGOMORPHA

Family Leporidae

Lepus californicus

Black-tailed Jackrabbit

The black-tailed jackrabbit ranges throughout much the western United States and occurs throughout most of Texas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Hall 1981, Dunn et al. 1982, Schmidly 2004). It has been reported from Padre Island, North Padre Island, and PAIS (Bailey 1905, Raun 1959, Koepke 1969, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1988). I documented it by observation and the presence of tracks, which I typically saw on mudflats. Although I documented it across the entire length of PAIS in areas with little vegetation, it was more common at the southern end of North Padre Island (APPENDIX XIV).

Harris (1988) reported this species as common along Bird Island Basin Road at night. However, I never observed this species along Bird Island Basin Road and it was rarely seen adjacent to any roads. Although I generally documented this species infrequently within northern PAIS, I saw it commonly at one locality at the northern park boundary, west of the main entrance. In the fall of 2005, a fire burned 149 ha. Previous to this fire, I did not observe

jackrabbits in this area. However, after the fire I saw several individuals and captured a juvenile by hand.

Baccus et al. (1977) and Baker and Rabalais (1978) reported black-tailed jackrabbits as abundant in northern areas of North Padre Island as well as PAIS. Although the species was common in some places, I never observed it in abundance. It is likely that the presence of cattle facilitated a higher abundance of this species. Baker (1956) and Jones et al. (1983) reported that it favored areas disturbed by grazing and avoided tall grass. Cattle grazing maintained low levels of vegetation, and when cattle were removed from the island in 1971, it is likely the distribution of jackrabbits shrank to areas with shorter, less dense vegetation, primarily near the southern end of the island.

Specimens Reported (3). USA: Texas; Nueces County, Mustang Island (LSUMZ 1578, 1579);

*USA: Texas; Nueces, Mustang Island, 23 Mi S Port Aransas (TCWC 825)

Specimens Examined (3). USA: Texas; Nueces County, Padre Island (NMNH 31410, 31411, 31534)

Observational Localities (21). USA: Texas; Kleberg County, 19.36 Km South, 0.96 Km West

Flour Bluff, UTM 14-3042880N-669227E (1); USA: Texas; Kleberg County, 19.20 Km

South, 0.99 Km West Flour Bluff, UTM 14-3042829N-668900E (1); USA: Texas;

Kleberg County, 16.70 Km North, 16.38 Km East El Martillo, UTM 14-3042056N-

669914E (1); USA: Texas; Kleberg County, 9.95 Km North, 11.78 Km East El Martillo,

UTM 14-3035242N-665198E (1); USA: Texas; Kleberg County, 6.86 Km South, 7.76

Km East El Martillo, UTM 14-3018554N-661533E (1); USA: Texas; Kleberg County,

7.06 Km South, 8.06 Km East El Martillo, UTM 14-3018371N-661781E (1); USA:

Texas; Kenedy County, 15.07 Km South, 6.98 Km East El Martillo, UTM 14-3010100N-660746E (1); USA: Texas; Kenedy County, 41.28 Km North, 2.72 Km East Port Mansfield, UTM 14-2979303N-659531E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965486N-663673E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port Mansfield, UTM 14-2963896N-662426E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (1); USA: Texas; Kenedy County, 25.60 Km North, 6.40 Km East Port Mansfield, UTM 14-2963873N-662580E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 24.96 Km North, 6.02 Km East Port Mansfield, UTM 14-2963702N-662669E (1); USA: Texas; Kenedy County, 25.44 Km North, 4.48 Km East Port Mansfield, UTM 14-2963600N-661019E (1); USA: Texas; Kenedy County, 25.12 Km North, 4.96 Km East Port Mansfield, UTM 14-2963501N-661511E (1); USA: Texas; Kenedy County, 25.28 Km North, 4.72 Km East Port Mansfield, UTM 14-2963474N-661343E (1); USA: Texas; Kenedy County, 13.55 Km North, 10.61 Km East Port Mansfield, UTM 14-2951797N-667537E (1); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1); USA: Texas; Willacy County, 1.12 Km North, 10.94 Km East Port Mansfield, UTM 14-2939533N-667890E (1)

Captures (1). USA: Texas; Kleberg County, 19.75 Km S, 0.84 Km W Flour Bluff, UTM 14-3014946N-669286E (1)

ORDER SORICOMORPHA

Family Talpidae

Scalopus aquaticus

Eastern Mole

The eastern mole ranges throughout the eastern and central United States and reaches its southern distribution limit in northern Mexico (Baker 1951, Hall 1981, Yates and Pedersen 1982). Within Texas, it occurs in the eastern two-thirds of the state, including parts of the panhandle and south Texas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). It has been reported from Padre Island, North Padre Island, and PAIS (Bailey 1905, Jackson 1915, Raun 1959, Yates and Schmidly 1977, Baker and Rabalais 1978, Harris 1988). I frequently documented moles through the presence of runs, which were readily visible in areas with little vegetation. I saw mole runs from the northern park boundary to beach mile 39.5 (APPENDIX XV). I captured an individual by hand crossing Park Road 22, 1.53 km by road north of the park headquarters. Baker and Rabalais (1978) also mentioned that moles were not found on the southern end of North Padre Island.

Specimens Reported (1). USA: Texas; Nueces, Packery Channel Park (TCWC 53317);

Specimens Examined (3). USA: Texas; Padre Island (NMNH 19666); USA: Texas; Nueces County, Padre Island (NMNH 31403, 31404)

Observational Localities (20). USA: Texas; Kleberg County, 9.98 Km North, 7.06 Km East El Martillo, UTM 14-3042921N-669421E (1); USA: Texas; Kleberg County, 19.36 Km South, 0.96 Km West Flour Bluff, UTM 14-3042880N-669227E (1); USA: Texas; Kleberg County, 19.20 Km South, 0.77 Km West Flour Bluff, UTM 14-3042830N-

669003E (1); USA: Texas; Kleberg County, 19.20 Km South, 0.99 Km West Flour Bluff, UTM 14-3042829N-668900E (1); USA: Texas; Kleberg County, 13.70 Km North, 13.94 Km East El Martillo, UTM 14-3039266N-667355E (1); USA: Texas; Kleberg County, 13.63 Km North, 13.87 Km East El Martillo, UTM 14-3039040N-667275E (1); USA: Texas; Kleberg County, 9.95 Km North, 11.78 Km East El Martillo, UTM 14-3035242N-665198E (1); USA: Texas; Kleberg County, 9.92 Km North, 11.9 Km East El Martillo, UTM 14-3035211N-665286E (1); USA: Texas; Kleberg County, 9.70 Km North, 12.00 Km East El Martillo, UTM 14-3034984N-665402E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17 Km East El Martillo, UTM 14-3033984N-666680E (1); USA: Texas; Kleberg County, 6.91 Km South, 7.90 Km East El Martillo, UTM 14-3018489N-661631E (1); USA: Texas; Kenedy County, 15.07 Km South, 6.98 Km East El Martillo, UTM 14-3010100N-660746E (1); USA: Texas; Kenedy County, 15.33 Km South, 7.36 Km East El Martillo, UTM 14-3009982N-661048E (1); USA: Texas; Kenedy County, 15.23 Km South, 7.30 Km East El Martillo, UTM 14-3009963N-660982E (1); USA: Texas; Kenedy County, 54.72 Km North, 4.32 Km East Port Mansfield, UTM 14-3009281N-660035E (1); USA: Texas; Kenedy County, 54.54 Km North, 4.50 Km East Port Mansfield, UTM 14-2994215N-660504E (1); USA: Texas; Kenedy County, 54.53 Km North, 4.61 Km East Port Mansfield, UTM 14-2994175N-660664E (1); USA: Texas; Kenedy County, 0.34 Km South, 41.25 Km East Armstrong, UTM 14-2978155N-661577E (1); USA: Texas; Kenedy County, 0.34 Km South, 41.25 Km East Armstrong, UTM 14-2978149N-661486E (1); USA: Texas;

Kenedy County, 6.56 Km South, 41.70 Km East Armstrong, UTM 14-2971757N-661942E (1)

Captures (1). USA: Texas; Kleberg County, 13.09 Km N, 15.25 Km E El Martillo, UTM 14-3038417N-668766E (1)

ORDER CHIROPTERA

Family Molossidae

Tadarida brasiliensis

Brazilian Free-tailed Bat

The Brazilian free-tailed bat occurs throughout the southwestern and southern United States, Mexico, and Central and South America (Hall 1981, Humphrey 1982). During summer months, this species occurs throughout Texas (Keely and Tuttle 1999, Schmidly 2004). This species has been reported to occur on Padre Island, North Padre Island, and PAIS but only from within manmade structures. Bailey (1905) reported on a specimen that was captured in an old house at the northern end of Padre Island. Koepke (1969) reported a small colony from within PAIS at the “ranger station”, which is likely the current location of the Malaquite Beach Visitor Center. Baker and Rabalais (1978) reported on observations made by residents of individuals occasionally roosting in manmade structures from residential areas of North Padre Island. Harris (1988) reported it from the Malaquite Beach Visitor Center as well as the sewage treatment plant within PAIS.

On 28 October 2006, I saw two medium sized bats at the Malaquite Beach Visitor Center. After circling the building several times shortly after sunrise, the two bats roosted underneath the shutters of one of the windows on the north side of the building. The bats were

closely observed through the windows from the inside of the building. The pelage of both individuals was short, uniformly brown on the dorsal side, and lighter brown on the ventral side. The distal portions of the tail were free from the uropatagium. Based on these characteristics, I identified both individuals as Brazilian free-tailed bats

Different populations of Brazilian free-tailed bats within Texas are highly migratory (Glass 1982). Bailey (1905) reported on a specimen that was captured in November, and Harris (1988) noted individuals in the spring and fall. Given this timing, it is possible that this species is only present within PAIS for short periods throughout the year during migration. This species should be considered rare and its residency status is unknown.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kleberg County, 21.48 Km S, 0.48 Km W Flour Bluff, UTM 14-3040081N-669404E

Captures (0).

Family Vespertilionidae

Pipistrellus subflavus

Eastern Pipistrelle

The eastern pipistrelle occurs throughout the eastern half of the United States, through Mexico and Central America (Hall 1981). Within Texas, it occurs throughout the eastern two-thirds of the state (Bailey 1905, McCarley 1959, Dalquest 1968, Schmidly 2004). Zehner (1985) reported a specimen that was found clinging to the wall of a building approximately 2.4 km south of the main entrance of PAIS. It requires thermally stable roosts, which can consist

of caves, mines, crevices, and buildings as well as trees during summer months (Briggler and Prather 2003). Because potential roost sites are limited within PAIS, it is unlikely that species is a resident of the park. However, it may occur in low numbers on North Pare Island in the developed areas of Nueces County, and is likely an occasional visitor to PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

ORDER CARNIVORA

Family Felidae

Lynx rufus

Bobcat

The bobcat occurs throughout much of North America including the continuous United States (Hall 1981, McCord and Cardoza 1982, Woolf and Hubert 1998). In Texas, it is common and ranges throughout the state (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Baker and Rabalais (1978) reported a second hand observation of a bobcat by an oak mott near Packery Channel in 1965. Harris (1988) also reported a second hand observation made in 1967 of a bobcat near Packery Channel. Within PAIS, Park Service employees and oil and gas personnel reported bobcats in the vicinity of Pan Am road (6.85 Mi or 11.02 Km south of the end of Park Road 22). During this study, I identified tracks of bobcat at two locations, once in the middle of the island west of beach mile 35 and once on a mudflat adjacent to beach mile 52 (APPENDIX XVI). It is likely to occur across the entire length of

PAIS but its abundance is unknown. On Texas barrier islands, bobcats have only been reported from Matagorda Island (Bailey 1905; however, see Hice and Schmidly 2002). This represents the first records of this species from North Padre Island. Like other members in the family Felidae, bobcats are elusive, and it is likely their presence has gone unnoticed on other islands.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (3). USA: Texas; Kleberg County, 2.03 Km South, 10.83 Km East El Martillo, UTM 14-3023097N-664484E (1); USA: Texas; Kenedy County, 0.37 Km North, 40.05 Km East Armstrong, UTM 14-2978858N-660379E (1); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1)

Captures (0).

Family Canidae

Urocyon cinereoargenteus

Common Gray Fox

The common gray fox ranges from southern Canada through much of the United States to Central and South America (Hall 1981, Samuel and Nelson 1982). Within Texas, it is found statewide (Bailey 1905, McCarley 1959, Dalquest 1968, Schmidly 2004). Jones and Frey (in press) reported the first records of this species within PAIS. One gray fox was found dead at the entrance of Pan Am road (6.85 Mi or 11.02 Km south of the end of Park Road 22; Jones and Frey in press). Wounds on the animal's throat suggested that it was killed by a

coyote (Jones and Frey in press). In addition to this specimen, gray fox were encountered within PAIS on four other occasions (Table 2, APPENDIX XVII). All observations were north of beach mile 11.5 and one was on Dredged Material Island 113 (Jones and Frey in press).

Coyotes are significant predators of gray fox, and when threatened, gray fox readily climb trees (Bailey 1905, Terres 1939, Fedriani et al. 2000, Schmidly 2004). The high abundance of coyotes and the near absence of arborescent growth make this species an unlikely resident of PAIS. However, several components of the vegetation within PAIS are likely to facilitate the existence of gray fox (Jones and Frey in press). From Yarbrough Pass to the northern boundary of PAIS, I found several tunnels in gulfdune paspalum that were large enough for gray fox to pass through, but appeared too small to be used by coyotes, which are of larger body size. It is possible that gray fox made the tunnels to avoid or escape coyotes. Furthermore, all individuals were found within 1.6 km (1.0 mi) of black willow. It is likely that gray fox utilize the willow in addition to the dense vegetation for protection against predation. The range of gray fox within PAIS is likely restricted to northern regions of the park where black willow is found and should be considered rare.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (5). USA: Texas; Kleberg County, 15.97 Km North, 13.07 Km East El Martillo, UTM 14-3041392N-666603E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17 Km East El Martillo, UTM 14-3033984N-666680E (6); USA: Texas; Kleberg County, 2.03 Km South, 10.83 Km East El Martillo, UTM 14-3023097N-664484E (1); USA: Texas; Kenedy County, 2.13 Km South, 10.90 Km East El Martillo

(1); USA: Texas; Kenedy County, 9.55 Km South, 9.04 Km East El Martillo, UTM 14-3015589N-662725E (1)

Captures (0).

Canis latrans

Coyote

Coyotes are wide ranging in North America, occurring from Alaska to Costa Rica (Beckoff 1982). In Texas, it occurs statewide and has been reported as the most common large native carnivore in the Tamaulipan province in southern Texas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Early surveyors, including R.E. Halter, reported this species on Padre Island during the mid 1870's (Sherrod and Brown 1898). It has been reported from Padre Island, North Padre Island, and PAIS (Bailey 1905, Baccus et al. 1977, Raun 1959, Koepke 1969, Baker and Rabalais 1978, Harris 1988, Sissom et al. 1990). Coyotes were seemingly omnipresent along the entire length of PAIS. I frequently saw tracks traversing transects of Sherman traps, adjacent to mudflats, along the beach, and on most small islands in the Laguna Madre (Table 2, APPENDIX XVIII).

Coyotes appeared to consume a variety of food resources within PAIS. Feces on small islands were mostly composed of shell fragments from crabs. I observed individuals digging for, and consuming, ghost crabs (*Ocypode quadrata*) on the beach. During the winter of 2006, Park staff reported a partially consumed deer carcass on the beach at beach mile 50. They reported erratic deer and coyote tracks mingled with a blood trail from the dunes to the carcass. The deer was apparently trying to reach the Gulf of Mexico in order to escape the coyote attack. In addition to natural food sources, coyotes appeared to benefit from the

presence of humans on the island. I regularly saw them scavenging for food in and around dumpsters at Malaquite Beach Visitor Center, the campground north of the visitor center, near the picnic sites at Malaquite Beach. I also observed coyotes scavenge the remains of fish discarded by fisherman.

Specimens Reported (1). USA: Texas; Cameron County, 11 Mi N, 3 Mi E Port Isabel (ASNH 7914)

Specimens Examined (2). USA: Texas; Nueces County, Padre Island (NMNH 31529, A43403)

Observational Localities (43). USA: Texas; Kleberg County, 20.00 Km North, 14.85 Km East

El Martillo, UTM 14-3045550N-668298E (1); USA: Texas; Kleberg County, 19.84 Km

North, 15.44 Km East El Martillo, UTM 14-3045375N-668843E (1); USA: Texas;

Kleberg County, 19.68 Km North, 14.93 Km East El Martillo, UTM 14-3045111N-

668249E (1); USA: Texas; Kleberg County, 19.36 Km North, 14.72 Km East El

Martillo, UTM 14-3044885N-668014E (1); USA: Texas; Kleberg County, 17.34 Km

South, 0.86 Km West Flour Bluff, UTM 14-3044481N-667854E (1); USA: Texas;

Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041908N-

666653E (1); USA: Texas; Kleberg County, 15.97 Km North, 13.07 Km East El

Martillo, UTM 14-3041403N-666459E (1); USA: Texas; Kleberg County, 13.98 Km

North, 16.48 Km East El Martillo, UTM 14-3039362N-669791E (1); USA: Texas;

Kleberg County, 11.58 Km North, 14.80 Km East El Martillo, UTM 14-3037060N-

668317E (1); USA: Texas; Kleberg County, 8.99 Km North, 13.44 Km East El Martillo,

UTM 14-3034317N-666885E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17

Km East El Martillo, UTM 14-3033984N-666680E (1); USA: Texas; Kenedy County,

7.12 Km South, 9.79 Km East El Martillo, UTM 14-3018040N-663470E (1); USA:
 Texas; Kenedy County, 7.28 Km South, 9.12 Km East El Martillo, UTM 14-3017803N-
 663371E (1); USA: Texas; Kenedy County, 9.73 Km South, 6.96 Km East El Martillo,
 UTM 14-3015459N-660560E (1); USA: Texas; Kenedy County, 14.69 Km South, 8.13
 Km East El Martillo, UTM 14-3010881N-661970E (1); USA: Texas; Kenedy County,
 14.62 Km South, 8.13 Km East El Martillo, UTM 14-3010665N-661844E (1); USA:
 Texas; Kenedy County, 14.69 Km South, 8.06 Km East El Martillo, UTM 14-
 3010645N-661914E (1); USA: Texas; Kenedy County, 14.45 Km South, 8.16 Km East
 El Martillo, UTM 14-3010574N-661913E (1); USA: Texas; Kenedy County, 14.82 Km
 South, 8.16 Km East El Martillo, UTM 14-3010503N-661912E (1); USA: Texas;
 Kenedy County, 14.88 Km South, 8.13 Km East El Martillo, UTM 14-3010465N-
 661972E (1); USA: Texas; Kenedy County, 15.23 Km South, 7.30 Km East El Martillo,
 UTM 14-3009963N-660982E (1); USA: Texas; Kenedy County, 54.72 Km North, 4.32
 Km East Port Mansfield, UTM 14-3009281N-660035E (1); USA: Texas; Kenedy
 County, 25.92 Km South, 7.15 Km East El Martillo, UTM 14-2999362N-660902E (1);
 USA: Texas; Kenedy County, 25.92 Km South, 7.10 Km East El Martillo, UTM 14-
 2999191N-660847E (1); USA: Texas; Kenedy County, 8.72 Km North, 40.8 Km East
 Armstrong, UTM 14-2987792N-660813E (1); USA: Texas; Kenedy County, 8.46 Km
 North, 40.64 Km East Armstrong, UTM 14-2987750N-660662E (1); USA: Texas;
 Kenedy County, 8.32 Km North, 40.16 Km East Armstrong, UTM 14-2987742N-
 660619E (1); USA: Texas; Kenedy County, 0.34 Km South, 41.25 Km East Armstrong,
 UTM 14-2978153N-661609E (1); USA: Texas; Kenedy County, 6.56 Km South, 41.70

Km East Armstrong, UTM 14-2971664N-662052E (1); USA: Texas; Kenedy County, 12.86 Km South, 43.42 Km East Armstrong, UTM 14-2965551N-663765E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port Mansfield, UTM 14-2963896N-662426E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (1); USA: Texas; Kenedy County, 25.60 Km North, 6.40 East Port Mansfield, UTM 14-2963873N-662580E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 24.96 Km North, 6.02 Km East Port Mansfield, UTM 14-2963702N-662669E (1); USA: Texas; Kenedy County, 25.28 Km North, 4.64 Km East Port Mansfield, UTM 14-2963437N-661392E (1); USA: Texas; Kenedy County, 24.80 Km South, 47.84 Km East Armstrong, UTM 14-2954558N-666777E (1); USA: Texas; Kenedy County, 24.32 Km South, 45.92 Km East Armstrong, UTM 14-2954488N-666608E (1); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1); USA: Texas; Kenedy County, 31.84 Km South, 48.48 Km East Armstrong, UTM 14-2946905N-668979E (1); USA: Texas; Kenedy County, 32.00 Km South, 47.84 Km East Armstrong, UTM 14-2946869N-668642E (1); USA: Texas; Willacy County, 39.04 Km South, 48.80 Km East Armstrong, UTM 14-2939610N-669785E (1)

Captures (0).

Family Mustelidae

Taxidea taxus

American Badger

The American badger ranges from central Canada through much of the central and western United States and Mexico (Lindzey 1982). In Texas, it is only absent from eastern portions of the state and it is common in prairie habitats throughout its range (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). It has been reported from Padre Island, North Padre Island, and PAIS (Lloyd 1891, Baker and Lay 1938, Schantz 1949, Raun 1959, Koepke 1969, Long 1972, Baccus et al. 1977, Baker and Rabalais 1978, Harris 1888). During this study, I only documented it south of beach mile 44 to Mansfield Channel (APPENDIX XIX). Park Service employees reported it to be most common between beach miles 30 and 50 (D. Echols pers. com., Moorehead pers. comm). Two additional records come from a photograph taken in 2005 near beach mile 30 (48 km S Malaquite Beach Visitor Center by beach) and a road killed specimen near beach mile 35 (56 km S Malaquite Beach Visitor Center by beach).

I documented this species primarily through sign. In the southern portions of the island, the vegetation was less dense making tracks in sand and mud more visible. It is likely that as vegetation increases in density and height in northerly portions of the island, badgers as well as their sign become increasingly difficult to find. Furthermore, prior to the removal of cattle, much of North Padre Island was denuded of vegetation, making it easier to observe badgers. Considering that the primary food item of the badger is ground squirrels (Snead and Hendrickson 1942, Schmidly 2004), it is likely that their range extends the entire length of PAIS and is sympatric with spotted ground squirrels. This species should be considered uncommon.

Specimens Reported (1). USA: Texas; Cameron County, 6.5 Mi N, 3 Mi E Port Isabel (ASNH 5378)

Specimens Examined (1). USA: Texas; Nueces County, Padre Island (NMNH A43397)

Observational Localities (7). USA: Texas; Kenedy County, 48 Km South of the end of Park Road 22 by beach (1); USA: Texas; Kenedy County, 56 Km South of the end of Park Road 22 by beach (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (1); USA: Texas; Kenedy County, 25.12 Km North, 4.96 Km East Port Mansfield, UTM 14-2963501N-661511E (1); USA: Texas; Kenedy County, 13.55 Km North, 10.61 Km East Port Mansfield, UTM 14-2951797N-667537E (1); USA: Texas; Kenedy County, 32.48 Km South, 47.68 Km East Armstrong, UTM 14-2946901N-669014E (1); USA: Texas; Willacy County, 1.04 Km North, 11.58 Km East Port Mansfield, UTM 14-2939555N-668389E (1)

Captures (0).

Family Mephitidae

Mephitis mephitis

Striped Skunk

The striped skunk occurs throughout much of North America (Hall 1981, Godin 1982). Within Texas it ranges across the state where it occurs in wooded and brushy areas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Godin 1982, Schmidly 2004). Lloyd (1891), Howell (1901), and Baker and Rabalais (1978) reported it from Padre Island. Lloyd (1891) shot an individual at the northern end of Padre Island and wrote, "Mr. Curry and his boys...killed over a dozen. He says there is only one species here." Baker and Rabalais

(1978) reported three adjacent to Park Road 22 within PAIS. One was observed at night and the other two were road-killed individuals, but no specimens were retained. I smelled skunk twice within PAIS: once in an interior area of the island adjacent to beach mile 10 and once behind the primary dunes at beach mile 29 (APPENDIX XX). Because striped skunks are the only confirmed species of skunk on Padre Island, it is most likely that these individuals were striped skunks. In 2006, National Park Service employees found a striped skunk carcass in interior portions of PAIS near Pan Am road (6.85 Mi or 11.02 Km south of the end of Park Road 22). I examined the carcass and identified it as striped skunk based on the presence tail hairs with white bases and black tips, which is a distinguishing characteristic of this species. The status of this species within PAIS is unknown.

Specimens Reported (0).

Specimens Examined (2). USA: Texas; Nueces County, Padre Island (NMNH 31416, A43402)

Additional Localities (3). USA: Texas; Kleberg County, vicinity of Pan Am Road (1); USA:

Texas; Kleberg County, 6.69 Km South, 8.03 Km East El Martillo, UTM 14-3018440N-661697E (1); USA: Texas; Kenedy County, 8.48 Km North, 40.32 Km East Armstrong, UTM 14-2987762N-660719E (1)

Captures (0).

Family Procyonidae

Nasua narica

White-nosed Coati

The coati ranges from Arizona, New Mexico, and Texas and south through Mexico and Central America (Hall 1981, Kaufmann 1982). Within Texas, it occurs in woodland areas in the

southern part of the state (Bailey 1905, Blair 1952, Kaufmann 1982, Schmidly 2004). Reliable reports of coatis within PAIS were given to me by B. Sandifer (pers. com.). He observed one on the mudflats on the west side of the island adjacent to beach mile 20 and another at the park entrance in the early 1990's (date unknown). In January 1996, he saw one at beach mile 29 digging for crabs on the foredune. In 2005, D. Echols (pers. com.) saw photographs of a group of coatis at the Best Western Hotel (14050 S Padre Island Dr) adjacent to Packery Channel (USA: Texas, Nueces County, 4.62 Km S, 5.84 Km E Flour Bluff, 14-3057251N-675261E). These photos were not retained. Although coatis are probably present within PAIS, their status within PAIS is unknown.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Procyon lotor

Northern Raccoon

The common raccoon occurs throughout North America (Hall 1981, Kaufmann 1982). In Texas, it is common and occurs throughout the state (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). It has been documented from Padre Island, North Padre Island, and PAIS (Lloyd 1891, Goldman 1950, Raun 1959, Baker and Rabalais 1978, Harris 1988). I captured four individuals and commonly saw tracks around ponds across PAIS and on several small islands in the Laguna Madre (Table 2, APPENDIX XXI). Although I documented this species across the entire length of PAIS, it is likely restricted to areas with

ponds for food and water and in areas of high human use, as they like coyotes, benefit from close human interaction due to anthropogenic food sources.

Specimens Reported (0).

Specimens Examined (1). USA: Texas; Nueces County, Padre Island (NMNH A43400)

Observational Localities (27). USA: Texas; Kleberg County, 20.00 Km North, 14.85 Km East

El Martillo, UTM 14-3045550N-668298E (1); USA: Texas; Kleberg County, 19.84 Km North, 15.10 Km East El Martillo, UTM 14-3045396N-668390E (1); USA: Texas; Kleberg County, 19.52 Km North, 14.88 Km East El Martillo, UTM 14-3045048N-668047E (1); USA: Texas; Kleberg County, 19.36 Km North, 14.83 Km East El Martillo, UTM 14-3044901N-668003E (1); USA: Texas; Kleberg County, 17.34 Km South, 0.86 Km West Flour Bluff, UTM 14-3044481N-667854E (1); USA: Texas; Kleberg County, 18.02 Km South, 1.23 Km West Flour Bluff, UTM 14-3043845N-667553E (1); USA: Texas; Kleberg County, 16.96 Km North, 13.82 Km East El Martillo, UTM 14-3042239N-667323E (1); USA: Texas; Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041908N-666653E (1); USA: Texas; Kleberg County, 15.97 Km North, 13.07 Km East El Martillo, UTM 14-3041508N-666535E (1); USA: Texas; Kleberg County, 8.99 Km North, 13.44 Km East El Martillo, UTM 14-3034317N-666885E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17 Km East El Martillo, UTM 14-3033984N-666680E (1); USA: Texas; Kenedy County, 15.07 Km South, 6.98 Km East El Martillo, UTM 14-3010100N-660746E (1); USA: Texas; Kenedy County, 6.56 Km South, 41.70 Km East Armstrong, UTM 14-2971757N-661942E (1); USA: Texas; Kenedy County, 6.56 Km South, 41.70 Km East

Armstrong, UTM 14-2971664N-662052E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port Mansfield, UTM 14-2963896N-662426E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (1); USA: Texas; Kenedy County, 25.60 Km North, 6.40 East Port Mansfield, UTM 14-2963873N-662580E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 24.96 Km North, 6.02 Km East Port Mansfield, UTM 14-2963702N-662669E (1); USA: Texas; Kenedy County, 24.64 Km South, 45.6 Km East Armstrong, UTM 14-2954426N-666211E (1); USA: Texas; Kenedy County, 13.55 Km North, 10.61 Km East Port Mansfield, UTM 14-2951797N-667537E (1); USA: Texas; Kenedy County, 13.25 Km North, 10.27 Km East Port Mansfield, UTM 14-2951656N-667014E (1); USA: Texas; Willacy County, 40.00 Km South, 50.56 Km East Armstrong, UTM 14-2939566N-671536E (1); USA: Texas; Willacy County, 39.52 Km South, 49.60 Km East Armstrong, UTM 14-2939414N-670171E (1); USA: Texas; Willacy County, 1.25 Km North, 14.50 Km East Port Mansfield, UTM 14-2939399N-671516E (1); USA: Texas; Willacy County, 1.18 Km North, 14.61 Km East Port Mansfield, UTM 14-2939400N-671662E (1)

Captures (4). USA: Texas; Kleberg County, 8.99 Km North, 13.44 Km East El Martillo, UTM 14-3034317N-666885E (1); USA: Texas; Kenedy County, 15.07 Km South, 6.98 Km East El Martillo, UTM 14-3010100N-660746E (1); USA: Texas; Willacy County, 1.18 Km North, 14.61 Km East Port Mansfield, UTM 14-2939400N-671662E (2)

ORDER ARTIODACTYLA

Family Tayassuidae

Pecari tajacu

Collared Peccary

The collared peccary occurs from the southwestern United States to Argentina (Sowls 1966, 1978; Bissonette 1982). In Texas, it is restricted to southern and western portions of the state with introduced populations in the north (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). Baker and Rabalais (1978) reported on sporadic sightings during the 20th century. They also reported an observation within PAIS at the southern end of Big Shell Beach around beach mile 30. Harris (1988) also reported on second hand observations of this species along the Laguna Madre on North Padre Island in 1983.

I saw a herd of five peccaries adjacent to residential areas on North Padre Island, near Park Road 22, just north of the Kleberg-Nueces county line. I saw a dead individual adjacent to Packery Channel. Within PAIS, I found a skull along mudflats west of beach mile 48.

The collard peccary primarily feeds on various cacti and is capable of obtaining sufficient water from their diet when enough cacti are present (Eddy 1961, Bissonette 1982, Schmidly 2004). Since cacti and freshwater were limited within PAIS, this species is likely to be concentrated at the northern end of North Padre Island where succulent vegetation (cultivated by residents) is more common. This species is probably present within PAIS, but it is likely to be uncommon.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (3). USA: Texas, Nueces County, Packery Channel, 4.50 Km S, 6.44 Km E Flour Bluff, UTM 14-3057325N-675874E (1); USA: Texas, Nueces County, 9.92 Km S, 5.48 Km E Flour Bluff, UTM 14-3051914N -674974E (1); USA: Texas; Kenedy County, 18.91 Km North, 7.23 Km East Port Mansfield, UTM 14-2957152N-664083E (1)

Captures (0).

Family Bovidae

Boselaphus tragocamelus

Nilgai

The nilgai is native to India and Pakistan, but is one of the most abundant exotic ungulates in Texas (Schmidly 2004). They were first introduced to the King Ranch in southern Texas in the 1930's and have been used since for hunting and aesthetics on game ranches (Payne et al. 1987). Baker and Rabalais (1978) and Harris (1988) reported it within PAIS based on second hand observations across PAIS. D. Echols (pers. com.) reported removing individuals from PAIS in the 1990's. I received a reliable report of four coyotes chasing a female nilgai into the Gulf of Mexico at beach mile 23 in the 1990's (B. Sandifer pers. com.). I did not document it from the park during this study, but in 2006, I received reports of it from interior portions of the island adjacent to beach mile 4 (P. Slattery pers. com.). Shortly after receiving these reports, I searched the reported area but found no signs. Because nilgai are actively removed from PAIS (D. Echols pers. com.), it is likely that a breeding population does not exist within the park. New individuals within PAIS are likely to arrive through dispersal from the King Ranch.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (2). USA: Texas; Kleberg County, 6.4 Km South of the end of Park Road 22 by beach, 1.6 Km West of beach (1); USA: Texas; Kenedy County, 37 Km South of the end of Park Road 22 by beach (1)

Captures (0).

Family Cervidae

Odocoileus virginianus

White-tailed Deer

The white-tailed deer ranges from Canada to South America and occurs throughout most of the continuous United States (Hesselton and Hesselton 1982). In Texas, it is found in suitable areas throughout the state (Bailey 1905, Mearns 1907, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Early explorers reported it during the 18th and from surveys on Padre Island, North Padre Island, and PAIS (Bailey 1905, Koepke 1969, Baker and Rabalais 1978, Harris 1988, Sherrod and Brown 1989). I found it to be abundant throughout the year and found it across the entire length of PAIS including on many small islands in the Laguna Madre (Table 2, APPENDIX XXII). I frequently saw it adjacent to ponds across the entire length of PAIS. In addition to ponds, I frequently observed it and saw tracks on mudflats along the western length of PAIS. During the summers of 2005 and 2006, several newborn fawns were seen at the beginning of June in areas surrounding the Malaquite Beach Visitor Center. I saw it run through the water from Dredged Material Island 97 to Dredged Material Island 99.

Baker and Rabalais (1978) reported on tracks but never observed white-tailed deer on North Padre Island. During a seven-year period, Harris (1988) also never observed white-tailed deer within PAIS and considered it to be an occasional visitor to PAIS. Historical populations of white-tailed deer on PAIS are unknown, but it seems apparent that populations have increased over the last 25 years because they were frequently observed, sometimes in groups as large as twenty.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (40). USA: Texas; Kleberg County, 20.00 Km North, 14.85 Km East El Martillo, UTM 14-3045550N-668298E (1); USA: Texas; Kleberg County, 19.52 Km North, 14.88 Km East El Martillo, UTM 14-3045048N-668047E (1); USA: Texas; Kleberg County, 19.36 Km North, 14.72 Km East El Martillo, UTM 14-3044885N-668014E (1); USA: Texas; Kleberg County, 17.34 Km South, 0.86 Km West Flour Bluff, UTM 14-3044481N-667854E (1); USA: Texas; Kleberg County, 19.20 Km South, 0.77 Km West Flour Bluff, UTM 14-3042830N-669003E (1); USA: Texas; Kleberg County, 16.70 Km North, 16.38 Km East El Martillo, UTM 14-3042056N-669914E (1); USA: Texas; Kleberg County, 16.43 Km North, 13.23 Km East El Martillo, UTM 14-3041908N-666653E (1); USA: Texas; Kleberg County, 13.98 Km North, 16.48 Km East El Martillo, UTM 14-3039362N-669791E (1); USA: Texas; Kleberg County, 12.30 Km North, 15.17 Km East El Martillo, UTM 14-3037646N-668636E (1); USA: Texas; Kleberg County, 10.85 Km North, 14.50 Km East El Martillo, UTM 14-3036312N-667955E (1); USA: Texas; Kleberg County, 9.33 Km North, 14.75 Km East El Martillo,

UTM 14-3034569N-668125E (1); USA: Texas; Kleberg County, 8.99 Km North, 14.43
 Km East El Martillo, UTM 14-3034343N-668008E (1); USA: Texas; Kleberg County,
 8.99 Km North, 14.43 Km East El Martillo, UTM 14-3034343N-668008E (1); USA:
 Texas; Kleberg County, 8.99 Km North, 13.44 Km East El Martillo, UTM 14-3034317N-
 666885E (1); USA: Texas; Kenedy County, 8.67 Km North, 13.17 Km East El Martillo,
 UTM 14-3033984N-666680E (1); USA: Texas; Kleberg County, 8.32 Km North, 13.87
 Km East El Martillo, UTM 14-3033522N-667531E (1); USA: Texas; Kleberg County,
 8.03 Km North, 14.19 Km East El Martillo, UTM 14-3033396N-667637E (1); USA:
 Texas; Kleberg County, 0.29 Km South, 11.01 Km East El Martillo, UTM 14-
 3025135N-664584E (1); USA: Texas; Kleberg County, 6.91 Km South, 7.90 Km East
 El Martillo, UTM 14-3018489N-661631E (1); USA: Texas; Kleberg County, 7.06 Km
 South, 8.06 Km East El Martillo, UTM 14-3018371N-661781E (1); USA: Texas;
 Kenedy County, 14.45 Km South, 8.16 Km East El Martillo, UTM 14-3010574N-
 661913E (1); USA: Texas; Kenedy County, 15.10 Km South, 7.17 Km East El Martillo,
 UTM 14-3010135N-661049E (1); USA: Texas; Kenedy County, 15.01 Km South, 7.33
 Km East El Martillo, UTM 14-3010013N-661083E (1); USA: Texas; Kenedy County,
 54.72 Km North, 4.32 Km East Port Mansfield, UTM 14-3009281N-660035E (1); USA:
 Texas; Kenedy County, 23.92 Km South, 7.12 Km East El Martillo, UTM 14-
 3001088N-660974E (1); USA: Texas; Kenedy County, 25.92 Km South, 7.10 Km East
 El Martillo, UTM 14-2999191N-660847E (1); USA: Texas; Kenedy County, 54.53 Km
 North, 4.77 Km East Port Mansfield, UTM 14-2994195N-660554E (1); USA: Texas;
 Kenedy County, 54.53 Km North, 4.32 Km East Port Mansfield, UTM 14-2994174N-

660690E (1); USA: Texas; Kenedy County, 0.34 Km South, 41.25 Km East Armstrong, UTM 14-2978155N-661577E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.84 Km East Port Mansfield, UTM 14-2963896N-662426E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963881N-662328E (1); USA: Texas; Kenedy County, 25.60 Km North, 6.40 East Port Mansfield, UTM 14-2963873N-662580E (1); USA: Texas; Kenedy County, 25.44 Km North, 5.84 Km East Port Mansfield, UTM 14-2963803N-662293E (1); USA: Texas; Kenedy County, 25.60 Km North, 5.60 Km East Port Mansfield, UTM 14-2963802N-662105E (1); USA: Texas; Kenedy County, 24.96 Km North, 6.02 Km East Port Mansfield, UTM 14-2963702N-662669E (1); USA: Texas; Kenedy County, 25.28 Km North, 4.96 Km East Port Mansfield, UTM 14-2963489N-661303E (1); USA: Texas; Kenedy County, 24.64 Km South, 45.6 Km East Armstrong, UTM 14-2954426N-666211E (1); USA: Texas; Kenedy County, 12.88 Km North, 10.00 Km East Port Mansfield, UTM 14-2951281N-666731E (1); USA: Texas; Kenedy County, 32.48 Km South, 47.68 Km East Armstrong, UTM 14-2946901N-669014E (1); USA: Texas; Willacy County, 1.12 Km North, 12.26 Km East Port Mansfield, UTM 14-2939339N-669191E (1)

Captures (0).

Encroaching, Historical, Unconfirmed, and False Reports

ORDER RODENTIA

Family Sciuridae

Sciurus niger

Eastern Fox Squirrel

The eastern fox squirrel occurs throughout the eastern half of the United States and is expanding its range westward (Flyger and Gates 1982). It occurs throughout the eastern two-thirds of Texas, and reaches its southern distributional limit along the Mexico-Texas border (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Flyger and Gates 1982, Schmidly 2004). Although found in a wide variety of forest communities, it typically occurs in small forest patches dominated by oaks, hickories, walnut, and pines that provide suitable food resources (Koprowski 1994, Schmidly 2004).

I observed a large tree squirrel at the Padre Island Visitor Center, 14252 S Padre Island Drive, adjacent to Packery Channel on North Padre Island, Nueces County. The squirrel walked across a telephone wire and jumped into a tree when I approached it. The eastern gray squirrel (*Sciurus carolinensis*) also occurs in southern Texas (Flyger and Gates 1982, Schmidly 2004). However, this squirrel was identified as *S. niger* based on its large size, reddish brown dorsal pelage, rusty orange underparts, and no visible sign of white or gray in the pelage (Flyger and Gates 1982, Schmidly 2004).

In Oklahoma and Iowa, fox squirrels are most abundant in transition zones of prairie and oak savannah, while gray squirrels predominate in more mature forest (Flyger and Gates 1982). Furthermore, in east Texas, gray squirrels occur in dense river bottom woods and

swamps which are absent on North Padre Island (Flyger and Gates 1982). Fox squirrels inhabit open woodlands and have taken advantage of urban developments (Schmidly 2004). I frequently observed fox squirrels in urban areas of Corpus Christi.

This represents the first record of the eastern fox squirrel on North Padre Island. On Texas barrier islands this species was only previously known to occur on Galveston Island (Hice and Schmidly 1999, 2002). Hice and Schmidly (1999) suspected that populations on Galveston Island were the result of released pets. Flyger and Gates (1982) reported that introductions were an important mechanism for the species range expansion. It is likely it was introduced to North Padre Island, either purposefully or accidentally.

If fox squirrels are established on North Padre Island, they are likely to be restricted to residential areas on the north end of the island where trees are common. Small, scattered stands of trees, including black willow (*Salix nigra*) and live oak (*Quercus virginiana*), occur at the northern end of PAIS. The largest live oak mott is approximately 0.08 hectares. Although fox squirrels eat a variety of acorns and nuts (Flyger and Gates 1982), it is unlikely this species could persist within the park as a result of limited food availability.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1).--USA: Texas; Nueces County, North Padre Island, 14R-

3056074N-3056074E.

Captures (0).

Spermophilus mexicanus

Mexican Ground Squirrel

The Mexican ground squirrel ranges throughout much of western Texas and Tamaulipas, Mexico (Tomich 1982). Blair (1952) reported it as the most common and widespread ground squirrel in the Tamaulipan biotic province in south Texas. Yzaguirre (1974) reported this species from within PAIS. Subsequently, Baker and Rabalais (1978) disregarded reports of it from North Padre Island. With exception of Yzaguirre (1974), no specimens or observations of this conspicuous species have been made on North Padre Island. It is likely that Yzaguirre (1974) captured spotted ground squirrels (*Spermophilus spilosoma*), but misidentified them as *S. mexicanus*. It is unlikely this species occurs within PAIS or North Padre Island.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Heteromyidae

Perognathus merriami

Merriam's Pocket Mouse

Merriam's pocket mouse ranges from northeastern New Mexico and western Oklahoma to Tamaulipas, Mexico (Hall 1981). In Texas, it is found in the western two thirds of the state (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). Lloyd (1891) reported it as rare but captured it at the northern and southern end of Padre Island (reported in Bailey 1905).

Osgood (1900) also captured this species from Padre Island. Raun (1959) reported it on Padre Island without supporting information, and it is possible that he reported it based on historical records. I did not capture this species within PAIS.

Merriam's pocket mouse occurs in areas with short vegetation (< 15 cm) including arid brush lands, short grass prairie, and overgrazed pastures and appears to be limited tall dense vegetation (Blair 1952, Porter 1962, Dalquest and Horner 1984). During this study, only 19 transects had an average vegetation height of 15cm or less, and these were restricted to areas at the southern end of North Padre Island. Although Lloyd (1891) reported this species from the northern end of Padre Island, the vegetation height and density was greatest in northern portions of North Padre Island during this study. It is possible that cattle facilitated the existence of this species in northern portions of Padre Island during the 19th century by reducing vegetative cover and density. It is unknown, however, why this species was not documented more frequently during the 20th century. It is likely that this species was extirpated, and it should be considered part of the historical mammal fauna of Padre Island.

Specimens Reported (0).

Specimens Examined (4). USA: Texas; Nueces County, Padre Island (NMNH 31538); USA:

Texas; Cameron County, Padre Island (NMNH 30387, 30388, A42372)

Observational Localities (0).

Captures (0).

Chaetodipus hispidus

Hispid Pocket Mouse

The hispid pocket mouse ranges from North Dakota through the central United States and Tamaulipas, Mexico (Hall 1981). It is common throughout much of Texas and occurs in semiarid shrublands, cane fields, tall prairie, cotton fields, and a variety of other habitats, but avoids areas of dense grass (Bailey 1905, Glass 1947, Blair 1952, McCarley 1959, Dalquest 1968, Hall 1981, Schmidly 2004). Allen (1891, 1894) reported the only records of this species from Padre Island. Two specimens were collected in 1887 and 1891 from the northern part of the island in Nueces County. Neither I, nor other more recent investigators documented this species on North Padre Island. As with Merriam's pocket mouse, it is possible that cattle facilitated the presence of this species in northern portions of Padre Island by reducing vegetative cover. Similarly, it is unknown why this species was not documented more frequently during the 19th and 20th centuries. It is possible that irregular cattle operations coupled with the unstable dynamics of natural disasters including fires and hurricanes removed this species from Padre Island. It is likely that this species was extirpated, and it should be considered part of the historical mammal fauna of Padre Island.

Specimens Reported (0).

Specimens Examined (1). USA: Texas; Nueces County, Padre Island (AMNH 3479)

Observational Localities (0).

Captures (0).

Liomys irroratus

Mexican Spiny Pocket Mouse

The Mexican spiny pocket mouse ranges from extreme southern Texas to central Mexico and occurs in a variety dense shrub habitats including arid shrub lands and dense chaparral (Bailey 1905, Blair 1952, Dowler and Genoways 1972, Schmidly 2004). Thomas (1972) reported this species from Padre Island without supporting information. It is unlikely that this species occurs on North Padre Island because dense shrublands are absent.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Cricetidae

Ondatra zibethicus

Muskrat

Muskrats inhabit a variety of marsh habitats and range throughout most of Canada and the United States (Hall 1981, Perry 1982). In Texas, it occurs in parts of the Panhandle, through the eastern part of the state, and in limited parts of western Texas (Bailey 1905, Lay and O'Neil 1942, McCarley 1959, Dlaquest 1968, Schmidly 2004). A skull was given to me that was found in the foredunes at beach mile 37 in 2005. This is the first record of this species from North Padre Island. However, I found no other evidence of muskrat within PAIS, or on North Padre Island. The closest records to North Padre Island are from the Galveston

Bay area, which is approximately 160 km (100 mi) north along the coast (Lay and Oneil 1942, Hice and Schmidly 1999, Schmidly 2004).

Because muskrats are restricted to permanent water with marsh habitats, this species is most likely to occur within northern portions of PAIS. However, neither tracks, dens, nor other sign have been reported by staff or visitors. Since suitable habitats are found in close proximity to Bird Island Basin, PAIS headquarters, and the Malaquite Beach Visitor Center, it is unlikely this species could have gone unnoticed considering the heavy human visitation of these areas. The skull most likely washed ashore from other coastal regions where it occurs.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kenedy County, 3.78 Km South, 41.86 Km East

Armstrong, UTM 14-2974528N-662184E (1)

Captures (0).

Neotoma micropus

Southern Plains Woodrat

The southern plains woodrat occurs in the southern Great Plains of the south-central and southwestern United States as well as northeastern Mexico (Hall 1981). Within Texas, it occurs in the western two-thirds of the state where it is commonly found around cactus, mesquite, and other arid brushlands (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). Lloyd (1891) reported on a single second hand observation of a rat and concluded that it was this species. There have been no subsequent reports of this species on Padre Island, North

Padre Island, or PAIS. Since PAIS is dominated by coastal prairie, it is unlikely this species occurs within the park.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Peromyscus leucopus

White-footed mouse

The white-footed mouse ranges from Canada, through the eastern two-thirds of the United States to Mexico (Hall 1981). Within Texas, it occurs throughout the state in a variety of brushy and wooded habitats (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Blair (1952) reported it as the most common and widespread species within southern Texas but did not document from Mustang Island. Although Bailey (1905) reported that Lloyd captured it from Padre Island in 1891, I was unable to substantiate this by reviewing Lloyd's field catalog. More recently, Baker and Rabalais (1978) only reported it from oak motts adjacent to the Kenedy Causeway on North Padre Island. Although it is most likely to be found in areas dominated by trees on North Padre Island, Yzaguirre (1974) reported it within PAIS adjacent to beach mile nine (14.4 km south of the Malaquite Beach Visitor Center by beach). The vegetation where Yzaguirre trapped was composed exclusively of coastal prairie grasses, and he reported capturing *Dipodomys* and *Peromyscus* together on transects with 25% to 30% foliar cover. This habitat is not consistent with known habitat associations of *P. leucopus*. For example, near Brownsville it was common in willows along river banks (Bailey 1905). Alvarez

(1963) commonly captured it in forested and brushy areas in Tamaulipas, Mexico. Hall and Dalquest (1963) never found it in grasslands in the coastal areas of Veracruz and Schmidly (2004) claimed that it was almost completely absent from prairies. It is likely that Yzaguirre (1974) captured the northern grasshopper mouse (*Onychomys leucogaster*) and falsely identified them as *P. leucopus*. Yzaguirre (1974) and Baker and Rabalais (1978) did not retain specimens to confirm identifications.

I made several attempts to capture *P. leucopus* within PAIS and North Padre Island. I accumulated 64 trapnights at a live oak mott (*Quercus virginiana*) 0.5 miles north of headquarters (UTM 14-3037646N-668636E), 399.5 trapnights in stands of black willow at Bird Island Basin (UTM 14-3039040N-667275E), 650 trapnights at Interior mile 4 (UTM 14-3026371N-663363E), and 70 trapnights in live oak motts adjacent to Packery Channel (UTM 14-3057049N-675570E). Out of 1,183.5 trapnights in woody vegetation, only 2 cotton rats (*Sigmodon hispidus*) were captured. It is possible that it is found within the residential areas of the island where trees are more abundant. Furthermore, Foster (1965) concluded that the presence of *Peromyscus* on many of the Queen Charlotte Islands in British Columbia was a result of human transport. Because this species is common in southern Texas, it is possible that this species occasionally within PAIS as a result of human mediated transport.

Specimens Reported (1). USA: Texas; Nueces County, Mustang Island, 10 Mi SW Port

Aransas (TTU 89869)

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Peromyscus maniculatus

Deer Mouse

The deer mouse occurs throughout most of Canada, the United States, and Mexico (Hall 1981). Within Texas, it ranges throughout much of the state, but is rare in eastern and coastal areas (Bailey 1905, McCarley 1959, Dalquest 1968, Schmidly 2004). Although Bailey (1905) reported it from northern portions of the Tamaulipan biotic province in south Texas, Blair (1952) reported it as absent from the remaining portions of the same province. It was reported from Port Aransas, Mustang Island (TTU 91149, 91150). Because this species is less common in southern Texas than the white-footed mouse, it is possible that the reported deer mice were misidentified. Baker (1944), however, reported human mediated transport of this species. As with the white-footed mouse, it is possible that this species occasionally occurs on North Padre Island.

Specimens Reported (2). USA: Texas; Aransas County, Port Aransas (TTU 91149); USA:

Texas; Aransas County, Port Aransas, Farm Road 1781 (TTU 91150)

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Oryzomys couesi

Coues' Rice Rat

Coues' rice rat occurs in Texas from the southern Rio Grande Valley south to Coast Rica (Hall 1960, Schmidly 2004). Although Coues' rice rat closely resembles the marsh rice rat, Coues' rice rat is distinctly larger and browner (Benson and Gehlbach 1979). Previously, it

was reported from Green Island and other areas adjacent to Mansfield Channel on the mainland (Schmidt and Engstrom 1994). Green Island is a Dredged Material Island in the Lower Laguna Madre, and is only 18.8 km south of Mansfield Channel (USA: Texas, Willacy County, 17.83 Km S, 9.62 Km E Port Mansfield, UTM 14-2920237N-667065E).

I received photographs from C. Green (pers. com.) that were taken in 2007 of a supposed Coues' rice rat that was captured on Green Island. When compared to photographs of adult marsh rice rats that I captured from PAIS, the supposed Coues' rice rat appears larger in all respects and browner. The dorsal pelage of the pictured animal appeared light brown and the ventral pelage appeared a light yellowish brown. In contrast, dorsal pelage of the marsh rice rat appeared dark grayish brown and ventral pelage appeared light gray. When compared to photographs of adult hispid cotton rats that I took from PAIS, the pictured animal had a longer, less blunt snout, and had less coarse pelage. In both cases, the pelage of marsh rice rats and hispid cotton rats was more bicolored than the pictured animal. Although a positive identification was not made, it is unlikely the rat in the photograph was a marsh rice rat or a hispid cotton rat. It is probable that this individual is a Coues' rice rat.

I sampled salt and freshwater ponds adjacent to Mansfield Channel for this species but did not capture either the Coues' or marsh rice rats. Coues' rice rats are capable swimmers (Cook et al. 2001). Because they have been found to in such close proximity to the Mansfield Channel, it is likely they occasionally swim to southern portions of PAIS.

Specimens Reported (1). USA: Texas; Cameron County, 3.6 Mi N, 3 Mi E Port Isabel (ASNHC 5528)

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Muridae

Rattus norvegicus

Norway Rat

The Norway rat is native to Eurasia, but has obtained a worldwide distribution through human-mediated introductions (Courchamp et al. 2003, Russell and Clout 2004). It occurs commensally with humans and is found throughout much of Texas (Bailey 1905, McCarley 1959, Schmidly 2004). Koepke (1969) reported it from North Padre Island without supporting information. Although Baker and Rabalais (1978) reported this species from Mustang and South Padre islands in close association with humans, this species has not yet been reported from North Padre Island. Although it may occur in developed areas of North Padre Island, it is likely currently absent from PAIS. However, like the black rat, unintentional human-mediated introductions into PAIS could occur.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Myocastoridae

Myocastor coypus

Nutria

The nutria, or coypu, is native to the Patagonia subregion of South America but was introduced into North America, and it occurs sporadically in Canada and the western, central, and southern United States (McCarley 1959, Hall 1981, Willner 1982, Woods et al. 1992). It currently ranges throughout the eastern two-thirds of Texas where it occurs in aquatic and semi-aquatic environments (McCarley 1959, Schmidly 2004). Baker and Rabalais (1978) found a dead nutria within PAIS adjacent to the foredune in 1965 and speculated that it washed ashore from flooded areas on the mainland to the north of North Padre Island. They also reported visitor observations of nutria from freshwater ponds within PAIS. D. Echols (pers. com.) took photographs of a nutria walking in the surf along Closed Beach behind the headquarters building in the mid 1990's. I searched for evidence of nutria around the permanent water sources within PAIS and other areas of North Padre Island, but found no sign. However, I commonly saw it around water sources surrounding Port Aransas on Mustang Island, especially at Joan and Scott Holt Paradise Pond and the Leonabelle Turnbull Birding Center adjacent to the water reclamation facility on 28 October 2006 and 23 March 2007. It is unlikely that this species currently occurs within PAIS, but it would be easy for it to disperse across Mustang Island to North Padre Island during wet years when ephemeral ponds are full.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (2). USA: Texas; Nueces County, 0.15 Km N, 1.15 Km West Port Aransas, UTM 14-3080415N-689820E (1); USA Texas, Nueces County, 0.66 Km S, 1.83 Km W Port Aransas, UTM 14-3079685N, 689148E (1)
Captures (0).

ORDER LAGOMORPHA

Sylvilagus floridanus

Eastern Cottontail

The eastern cottontail occurs from southern Canada, the eastern two-thirds of the United States to northern South America (Hall 1981). Within Texas, it is found in much of the (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). The status of cottontail on Padre Island is ambiguous. Patrick Dunn, long time owner and operator of the Dunn Ranch on Padre Island, reported the disappearance of cottontails sometime before the 1870's (Price and Gunter 1943). Conversely, in a written summary of the Mammals of Padre Island in 1891, William Llyod stated, "no cottontail on [Padre] Island and Curry says none ever have been to his knowledge. Mr. Dunn had offered to buy some from the mainland to have them introduced but his scheme...has fallen through up to date".

Raun (1959) reported it from Padre Island based on observations made by residents but gave no other supporting evidence of its presence. Koepke (1969) reported it from Padre Island but with no supporting evidence. In PAIS, Baker and Rabalais (1978) reported cottontails in oak motts and dense vegetation around the ponds west of the Malaquite Beach Visitor Center. B. Sandifer (pers. com.) reported observations of cottontails at the visitor

center, Yarborough Pass adjacent to beach mile 15, and on the Back Island Road between beach miles 18 and 29, but no date was reported.

I found no specimens, or other evidence of cottontails within PAIS or North Padre Island. It is possible that observers confused this species with juvenile black-tailed jackrabbits. Its historical and current status on North Padre Island and within PAIS is unknown.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kleberg County, 2.03 Km South, 10.83 Km East El Martillo, UTM 14-3023097N-664484E (1)

Captures (0).

ORDER SORICOMORPHA

Family Soricidae

Cryptotis parva

Least Shrew

The least shrew occurs throughout much of the eastern and central United States (Whitaker 1974). It occurs throughout much of central and eastern Texas where it occurs in grassland areas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Raun (1959) and Rabalais (1975) reported it as possible on Padre Island or North Padre Island. Although McCarley (1959) reported it as common in coastal prairies, it has not been recorded on the barrier island system of Texas. In 365 pitfall trapnights, no individuals were captured. Because pitfall traps were placed in few areas restricted to northern portion of PAIS, it is possible for this species to occur in other areas across North Padre Island.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Notiosorex crawfordi

Desert Shrew

The desert shrew ranges throughout the southwestern and south central United States and Mexico (Armstrong and Jones 1972). Within Texas, it occurs within the western half of the state but is not restricted to any particular habitat (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). Raun (1959) reported it as possible on Padre Island or North Padre Island but it has not been documented on the Texas barrier island system. In 365 pitfall traps, no individuals were captured. Because pitfall traps were placed in few areas restricted to northern portion of PAIS, it is possible for this species to occur in other areas across North Padre Island.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

ORDER CHIROPTERA

Family Vespertilionidae

Eptesicus fuscus

Big Brown Bat

The big brown bat occurs throughout North America and Texas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Humphrey 1982, Schmidly 2004). Raun (1959) reported it as a possible on Padre Island. Although this species has not been documented within PAIS, it is likely to occasionally visit from the adjacent mainland.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Nycticeius humeralis

Evening Bat

The evening bat ranges throughout much of the eastern United States (Watkins 1972). Within Texas, it ranges throughout the eastern and southern portions of the state (Bailey 1905, Blair 1952, McCarley 1959, Schmidly 2004). Raun (1959) and Rabalais (1975) reported this species as possible on Padre Island and North Padre Island, but this species has not been recorded. This tree bat is an unlikely resident, but it is likely to occasionally visit PAIS from the adjacent mainland.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Lasiurus borealis

Red Bat

The red bat occurs throughout the eastern and part of the western United States (Humphrey 1982). It occurs throughout Texas (Bailey 1905, Blair 1952, McCarley 1959, Dalquest 1968, Schmidly 2004). Raun (1959) and Rabalais (1975) reported this species as possible on Padre Island and North Padre Island, but this species has not been recorded. This tree bat is an unlikely resident, but it is likely to occasionally visit PIAS from the adjacent mainland.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Lasiurus cinereus

Hoary Bat

The hoary bat ranges throughout much of North and South America, is found throughout Texas, and frequents wooded areas (Shump and Shump 1982, Schmidly 2004). As with other lasiurines, hoary bats are considered tree bats that roost in trees year round (Cryan and Veilleux 2007). In August 2007, I received photos from C. Haralson and C. Boal of a male Hoary bat that had been partially consumed at a white-tailed hawk nest on Matagorda Island. The bat was independently identified as *L. cinereus* by M. Bogan and E. Valdez (pers.

com.). Because lasiurines (genus *Lasiurus*) typically roost alone or in small family groups (Barbour and Davis 1969), and because trees are uncommon within PAIS, this species is an unlikely resident within the park. It is likely that visitors from the mainland occur occasionally. Furthermore, like other lasiurines, Hoary bats are highly migratory and move into northern latitudes during summer months and southern latitudes during winter months (Cryan 2003). It is likely that this species is most common during migration within PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Matagorda Island (1)

Captures (0).

Lasiurus intermedius

Northern Yellow Bat

The northern yellow bat occurs in coastal states from South Carolina to Texas, through Mexico and Central America (Hall 1981). Within Texas, it occurs in the eastern quarter of the state where it parallels the Gulf of Mexico from Louisiana to Mexico (Bailey 1905, McCarley 1959, Schmidly 2004). Miller (1897) and Bailey (1905) reported it from the southern end of Padre Island, but neither provided supporting information of where it was captured. Raun (1959) reported it from Padre Island, but without any supporting evidence.

Upon reviewing photos archived at the Malaquite Beach Visitor Center, I found a photo of a *Lasiurus* sp. clinging to the outside wall of a building at the park headquarters. The photo contained no supporting information but was suspected to be *L. intermedius*. The bat in the photo appeared to have long hair on the back, brownish wing membranes which are

distinguishing characteristics of *L. intermedius*, and appeared to lack conspicuous frosting and white patches on the shoulders and wrists which are found in other species members of the same genus (M. Bogan pers. com., P. Cryan pers. com., E. Valdez pers. com.).

Yellow bats appear to be among the most common tree bats in southern Texas. A museum query of *Lasiurus* sp. in a 200 km radius of PAIS resulted in 211 records of *L. intermedius*, 23 of *L. borealis*, 7 of *L. blossevillii*, and 3 *L. cinereus* (P. Cryan pers. com.). Schmidly (2004) reported this species to roost in Spanish moss and palm trees in Texas. Palm trees are common in residential areas on North Padre Island and the adjacent mainland, but do not occur within PAIS. It is likely that visitors from the mainland occur occasionally. Furthermore, like other lasiurines, Hoary bats are highly migratory and move into northern latitudes during summer months and southern latitudes during winter months (Cryan 2003). It is likely that this species is most common during migration within PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kleberg County, Padre Island National Seashore

Headquarters, approximately 11.6 Km North, 14.8 Km East El Martillo (1)

Captures (0).

Lasiurus seminolus

Seminole Bat

The Seminole bat occurs in southeastern and coastal states from Texas to North Carolina (Wilkins 1987). Within Texas, it occurs from the eastern part of the state (McCarley 1959, Schmidly 2004). Raun (1959) and Rabalais (1975) reported this species as possible on

Padre Island and North Padre Island, but this species has not been recorded. This tree bat is an unlikely resident or visitor of PAIS. Although Bailey (1905) reported on a specimen captured near Brownsville, the current range of this species is not known to extend to southern portions of the state.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Myotis velifer

Cave Bat

The cave bat occurs in parts of the central and southwestern United States where it roosts in caves and buildings (Fitch et al. 1981). Within Texas it occurs throughout much of the western and southern part of the state (Bailey 1905, Blair 1952, Dalquest 1968, Schmidly 2004). Raun (1959) reported this species as possible on Padre Island. It is an unlikely resident of PAIS since few roosts sites are available. It is possible that this species occasionally visits North Padre Island from the adjacent mainland.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

ORDER Carnivora

Family Felidae

Felis catus

House Cat

The house cat is widespread since it occurs commensally with humans (Todd 1977). On Padre Island, feral cats appear to be uncommon. Lloyd collected a skull in the late 19th century (NMNH A43401). During this study PAIS employees gave me a skull of a house cat that was found at the northern end of PAIS. D. Echols (pers. com.) reported occasionally removing house cats from PAIS. While individual cats are occasionally observed, I did not document any evidence of feral populations within PAIS or North Padre Island. Although its presence is uncommon, the high visitation rate and close proximity to residential areas make PAIS particularly susceptible to invasion by feral cats. Feral populations of cats have caused considerable damage to native species of reptiles, birds and mammals, especially on islands (Whittaker 1998). Burbidge and Manly (2002) reported that mammal extinctions were more likely to occur on arid islands where native mammals are restricted to the grounds surface.

Specimens Reported (0).

Specimens Examined (1). USA: Texas; Nueces County, Padre Island (NMNH A43401)

Observational Localities (1). USA: Texas, Kleberg County, 14.98 Km N, 16.69 Km E El

Martillo, UTM 14-3040350N-670131E (1)

Captures (0).

Leopardus pardalis

Ocelot

The ocelot ranges from the southern Rio Grande Valley in south Texas to northern Argentina (Bailey 1905, Hall 1981, Murray and Gardner 1997, Schmidly 2004, Haines et al. 2005). Harris (1988) reported unverified visitor reports from 1982 of an ocelot running along the gulf beach. This is the only report of this species on North Padre Island. Within Texas, it occurs in dense thorn scrub (Haines et al. 2005). Although North and South Padre islands are dominated by coastal prairie, much of the mainland adjacent to both islands is dense scrub, composed of species including mesquite, acacia, and oak. Extant populations are known to occur within Laguna Atascosa National Wildlife Refuge, which is approximately 17 miles (28 Km) south-southwest of PAIS. Individuals, especially juveniles, could disperse to PAIS, but their status should be considered temporary.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Puma concolor

Cougar

Historically, cougars occurred throughout North and South America; however, it has been extirpated in many areas of the United States (Hall 1981, Dixon 1982, Currier 1983). Although once widespread in Texas, the current range is primarily restricted to areas in the western and southern parts of the state where it is usually found in dense shrublands (Bailey

1905, Baker 1949, Blair 1952, Dalquest 1968, Schmidly 2004). However, it occupies a variety of habitats, and in eastern portions of its range, it is restricted largely by the habitat and distribution of white-tailed deer, its primary prey (Dixon 1982, Currier 1983).

R.E. Halter, a surveyor from the U.S Coast and Geodetic Survey, reported it from Padre Island in 1878. He wrote, "I use [a rifle] for protection against coyotes, wolves and panthers which become more plenty as we go down the island" (Sherrod and Brown 1989). Baker and Rabalais (1978) reported on a visitor observation of a cougar adjacent to beach mile 5.5 (8.8 km south of the Malaquite Beach Visitor Center) in 1966. Although it is likely more common on the mainland of Texas, it is not surprising that cougars have been reported on the island, especially considering the current high abundance of white-tailed deer. This species is likely to occur sporadically within PAIS, but its status should be considered extremely rare.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Puma yagouaroundi

Jaguarundi

The jaguarundi occurs in southeast Arizona, south Texas, through Central and South America (Hall 1981). Within Texas, it is typically found in dense thorny shrublands of the lower Rio Grande Valley (Bailey 1905, Tewes and Everet 1986, Schmidly 2004). B. Sandifer (pers. com.) reported second hand observations of jaguarundi on Big Shell Beach between beach miles 18 and 30 during the 1970s. Because PAIS is dominated by coastal prairie, it is unlikely

for a resident population of this species to occur within the park. Like all felids, it is elusive and secretive, and it is possible for dispersing individuals, especially juveniles, go undetected within PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Panthera onca

Jaguar

The jaguar once ranged through the southwestern United States and Texas through South America, but it has been nearly extirpated in the United States (Hall 1981, McCain and Childs 2008). In Texas, it was found in dense chaparral across much of the state, but it is currently considered extirpated within the state (Bailey 1905, Taylor 1947, Blair 1952, McCarley 1959, Schmidly 2004). Jaguar food habits are not well known, but in Mexico, they are known to prey on peccaries and white-tailed deer in addition to sea turtle eggs (Schmidly 2004), making Padre Island suitable at least in terms of food availability. Baker and Rabalais (1978) reported an observation of a jaguar with two cubs at beach mile 35. As with other large carnivores, home ranges of this species are very large and individuals are capable of dispersing great distances. Although jaguars are an unlikely visitor, it is possible for this species to occur within PAIS from time to time. Their presence should be considered temporary.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Canidae

Canis lupus familiaris

Domestic Dog

Stray and abandoned dogs are occasionally found within PAIS. D. Echols (pers. com.) reported taking dogs from PAIS to animal shelters. I observed a pair of dogs adjacent to beach mile 35. These two dogs were apparently at this location for 4 weeks before they were retrieved. Although stray dogs occur occasionally, it is unlikely that feral populations occur within the park.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kenedy County, 0.34 Km South, 41.25 Km East

Armstrong, UTM 14- 2978151N-661636E

Captures (0).

Family Canidae

Canis lupus familiaris x latrans

Domestic Dog, Coyote hybrid

Lloyd (1891) reported a litter between a dog and coyote on Padre Island. Since dogs are unlikely residents of PAIS, hybrids between coyotes and dogs should be considered extremely rare, although possible.

Specimens Reported (0).

Specimens Examined (1). USA: Texas; Padre Island (NMNH A43404)

Observational Localities (0).

Captures (0).

Canis rufus

Red Wolf

The red wolf once ranged from southern Pennsylvania to Florida and west to central Texas, with western range limit on the Edward's Plateau (Bailey 1905, McCarley 1959, Nowak 1979, Paradiso and Nowak 1982, Hall 1981, Schmidly 2004). By the 1970's red wolves were extirpated from the wild as a result of human persecution and genetic degradation (Paradiso and Nowak 1982). As the range of coyotes expanded as a result of shrinking red wolf populations, red wolves and coyotes began to interbreed (Paradiso and Nowak 1982, Phillips et al. 2003, Fredrickson and Hendrick 2006). The last populations of pure red wolves existed within Louisiana and Texas (Paradiso and Nowak 1982). Approximately 24 red wolves were removed from the wild for a captive breeding program before the genetic integrity of remnant red wolf populations were destroyed by hybridization events with coyotes.

R.E. Halter reported wolves on Padre Island in 1878 (Sherrod and Brown 1989). Bailey (1905) reported records from Corpus Christi in 1897. In 1948 a specimen was taken from Port Aransas on Mustang Island. Because large carnivores occupy large home ranges, and because Mustang and Padre Island have been repeatedly connected, it is likely that red wolves inhabited North Padre Island. Within PAIS, unusually large canids are occasionally reported (D. Echols pers. com.). B. Sandifer reported observing a 65-80 pound canid at beach

mile 28 in 1992 (pers. com.). It is possible that red wolf genes exist in the coyote gene pool within PAIS. This species should be considered part the historical mammal fauna of PAIS.

Unless reintroductions occur within PAIS, it will remain absent from the island's fauna.

Specimens Reported (1). USA: Texas; Nueces County, Mustang Island, Port Aransas (KU 27345)

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Mustelidae

Mustela frenata

Long-tailed Weasel

The long-tailed weasel ranges throughout much of North America and part of South America (Svendsen 1982). It occurs throughout much of Texas except northern portions of the state (Bailey 1905, Blair 1952, McCarley 1959, Schmidly 2004). Thomas (1972) reported this species as possible on Padre Island. Its prey includes small mammals, especially ground squirrels and gophers (Svendsen 1982, Schmidly 2004). Although it has not been documented within PAIS, it is possible that this species occurs within the park and has gone unnoticed.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Mephitidae

Conepatus leuconotus

North American Hog-nosed Skunk

The hog-nosed skunk ranges along coastal areas from southern Texas to Veracruz, Mexico (Bailey 1905, Hall 1981, Howard and Marsh 1982, Schmidly 2004). Bailey (1905) reported that Lloyd documented this species from Padre Island; however, there is no indication of this species in Lloyd's (1891) field catalog. Raun (1959) reported it from Padre Island, but with no supporting evidence. It has been extirpated from the eastern part of Texas, and it is likely that populations in the South Texas Plain have met the same fate (Schmidly 2004). The status of this species within PAIS is unknown.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Spilogale putorius

Eastern Spotted Skunk

The spotted skunk ranges from southern Canada, through the eastern and central United States into Tamaulipas, Mexico (Hall 1891, Howard and Marsh 1982). Within Texas, it occurs in the eastern two-thirds of the state (Bailey 1905, Howell 1906, McCarley 1959, Dalquest 1968, Schmidly 2004). Price and Gunter (1943) reported that Patrick Dunn, owner and longtime operator of the Dunn Ranch on Padre Island, stated that spotted skunks disappeared sometime after 1870. This is the only report of spotted skunks on Padre Island

and should be considered questionable. I did not document this species within PAIS.

Although this species commonly occurs in prairie habitats (Davis 1945, Schmidly 2004), its historical and current status within PAIS is unknown.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

ORDER PERISSODACTYLA

Family Equidae

Equus caballus

Horse

Horses have been associated with military and ranching operations on Padre Island since the early 1800's (Reid 1846, Baker and Rabalais 1978, Sherrod and Brown 1989, L. Moorehead pers. com.). There are no feral horses on North Padre Island, but they are occasionally brought to Padre Island for recreational use. This species should be considered part of the historical mammal fauna of PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

ORDER ARTIODACTYLA

Family Suidae

Sus scrofa

Feral Pig

Feral hogs were reported on the island as early as 1863 (Sherrod and Brown).

However, it is possible that these early reports were of collard peccary. Baker and Rabalais (1978) reported on observations by Patrick Dunn during the early 20th century as well as second hand observations of a hog around beach mile 43. D. Echols (pers. com.) reported observations from a volunteer who purportedly saw a feral pig adjacent to the headquarters building in 1996. I did not document this species within PAIS. This species commonly makes wallows in mesic areas. The only permanent ponds within PAIS are restricted to northern portions of the park. Because these sources of water are in close proximity to developed areas within PAIS, it is unlikely this species could have gone unnoticed. It is possible, however, for individuals to cross from the mainland where they are common (pers. obs.).

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (0).

Captures (0).

Family Bovidae

Bos taurus

Cow

Cattle were first introduced on Padre Island about 1805 and were removed from North Padre Island and PAIS in 1971 with the exception of a few stray individuals (Baker and Rabalais 1978, National Park Service 2008b, L. Moorehead pers. com.). A femur was found adjacent to Black Hill line camp around beach mile 11. This species should be considered part of the historical mammal fauna of PAIS.

Specimens Reported (0).

Specimens Examined (0).

Observational Localities (1). USA: Texas; Kenedy County, 9.02 Km South, 8.67 Km East El

Martillo, UTM 14-3016460N-662730E (1)

Captures (0).

DISCUSSION

Through literature searches, museum surveys, and fieldwork, 62 species of non-marine mammals were either documented or reported on Padre Island or North Padre Island. Of these species, 51 were native and 11 non-native. Within PAIS, 26 species were present or probably present, 19 were encroaching, and 9 were unconfirmed, 6 were historical, and 2 were false reports.

Of the 11 non-native species documented on Padre Island, North Padre Island, or PAIS, the horse (*Equus caballus*) and the cow (*Bos taurus*) are historical and have been removed from the park. A single coyote-dog hybrid litter was reported but is considered historical; however, it is unknown what impact this has had on the genetic integrity of coyotes on Padre Island. Within PAIS, the nutria (*Myocastor coypus*), house cat (*Felis catus*), domestic dog (*Canis lupus familiaris*), and feral pig (*Sus scrofa*) have been reported in the past but are currently considered encroaching. Coupled with the Norway rat (*Rattus norvegicus*), these species are the most likely to invade PAIS given their close proximity to the park. Although the Norway rat has not been confirmed within PAIS, it occurs commensally within humans and has a high probability of being transported into the park.

The house mouse (*Mus musculus*), roof rat (*Rattus rattus*), and nilgai (*Boselaphus tragocamelus*) are the only non-native species currently present within PAIS. Because park personnel actively remove nilgai, it is unlikely resident populations occur within PAIS even though individuals are likely to continually disperse to North Padre Island. The house mouse and roof rat appear to be locally abundant adjacent to Mansfield Channel. Outside human habitations, the house mouse was only captured at the extreme southern end of PAIS.

Similarly, the roof rat was only captured at the Mansfield Channel Jetty. Although the range of these species was restricted to the southern end of PAIS, it is possible that these species will spread to other areas of PAIS. Eradication of non-native rats and mice has been successful on islands adjacent to New Zealand (Towns and Broome 2003). Given the restricted distribution of these species within PAIS, implementing a successful eradication plan is plausible.

Of the non-native species, cattle have played the greatest role in shaping the distribution and composition of the mammals on Padre Island and North Padre Island. During the 19th and 20th centuries, cattle are likely to have facilitated the northward expansion of more arid adapted species by maintaining short, sparse vegetation. Many species appeared to benefit from the presence of cattle including the armadillo (*Dasypus novemcinctus*), black-tailed jackrabbit (*Lepus californicus*), Merriam's pocket mouse (*Perognathus merriami*), hispid pocket mouse (*Chaetodipus hispidus*), northern grasshopper mouse (*Onychomys leucogaster*), and the American badger (*Taxidea taxus*), which were found on Mustang Island and northern portions of North Padre Island. Following the removal of cattle in the early 1970's, the vegetation on North Padre Island began to recover. L. Moorehead (pers. com.) described the vegetation during this time at the northern end of North Padre Island as knee length but sparse. During this study, however, the vegetation throughout the northern half of North Padre Island was dominated by tall, dense grass. During this time of vegetative succession, the range of many species receded to more southerly portions of North Padre Island. Of the previously mentioned species, only the black-tailed jackrabbit was found on the northern half of North Padre Island during this study. It is unknown if the range of many

species will continue to shrink on North Padre Island or if the vegetation has reached a climax state.

Unlike other arid adapted species, the Gulf Coast kangaroo rat (*Dipodomys compactus*) and the spotted ground squirrel (*Spermophilus spilosoma*) were documented across the entire length of PAIS during this study. Although the vegetation throughout the northern half of North Padre Island was dominated by tall dense grass, short sparse vegetation was maintained adjacent to the beach by wind and tidal action throughout the foredune and primary dune systems. This continual disturbance is likely to have facilitated the persistence of both species on northern portions of North Padre Island. In northern portions of PAIS, both species were almost exclusively captured within the foredune and primary dune system. It is interesting to note that the northern grasshopper mouse was never documented within the foredune or primary dune despite the fact that suitable habitat appeared to exist. It is possible that the Gulf Coast kangaroo rat and the spotted ground squirrel have adapted to persisting within this continually disturbed environment while the northern grasshopper mouse has not. This might explain why the range of the northern grasshopper mouse receded during the last quarter of the 20th century, while no range reduction was documented for the Gulf Coast kangaroo rat or spotted ground squirrel.

Over the last two centuries, at least three native species have been extirpated on Padre Island and North Padre Island. These species include the red wolf (*Canis rufus*), Merriam's pocket mouse (*Perognathus merriami*), and hispid pocket mouse (*Chaetodipus hispidus*). The disappearance of the red wolf was almost certainly a result of human persecution and introgression with coyotes (Paradiso and Nowak 1982, Phillips et al. 2003,

Fredrickson and Hendrick 2006). Persecution by humans is the primary reason behind local extirpation of many carnivores and could explain why other large carnivores, including the jaguar (*Felis onca*) and cougar (*Puma concolor*) are rare on North Padre Island (Woodroffe 2000).

Reasons for the disappearances of the two pocket mice are less clear. Although these species undoubtedly benefited from the presence of cattle, the effects of overgrazing were likely to have negatively impacted both tall grassland and arid grassland adapted species. In extreme cases, grazing, coupled with hurricanes and fire, denuded much of the vegetation over large tracts of Padre Island during the late 19th and early 20th centuries. This is likely to have created an inhospitable environment for most terrestrial species. It is possible that Merriam's pocket mouse and the hispid pocket mouse were unable to cope with the rapid environmental changes that occurred during this time, which may have resulted in their extirpation. It is likely that many heteromyids are less adept at dispersing over water when compared to cricetids and murids. It would therefore be less likely for heteromyids to recolonize North Padre Island after extirpation.

Before this study, relatively little effort was invested in mammal surveys on Padre Island and North Padre Island. However, the mammal fauna was surprisingly well documented. In studies where Sherman trap effort was reported, a total of 8220 trapnights was accumulated on Mustang and North Padre islands during all combined previous studies (Baker and Lay 1938, Blair 1952, Koepke 1969, Yzaguirre 1974, Baccus et al. 1977, Harris 1988, Goetze et al. 1999). During this survey, a total of 32,241 Sherman traps were set accumulating a total of 32,101 trapnights. Although this effort was nearly 4 times greater than

during previous studies, no additional small mammal species were documented. The greatest proportion of unconfirmed and encroaching species were bats and carnivores. This is to be expected since these species are relatively more difficult to sample. It is likely that some species, especially bats and carnivores, are present on North Padre Island and within PAIS but have gone unnoticed.

SMALL MAMMAL COMMUNITY STRUCTURE IN THE LOWER REGION OF THE COASTAL TEXAS PRAIRIE

Within North America grasslands, community structure of small mammal assemblages has been a focal point in many ecological studies (Grant and Birney 1979; Glass and Slade 1980; Hallett et al. 1983; Brady and Slade 2001, 2004; Reed et al. 2006). Predictably, ecologists evoke interspecific competition and habitat heterogeneity as the dominant mechanisms structuring nonrandom patterns of species assembly. Traditionally, competition has been divided into exploitative and interference competition (Schoener 1983). Exploitative competition is driven by differential resource acquisition where species compete for limited resources and exclude competitively inferior species (Park 1962). Conversely, interference competition operates when physical interactions between two species affect the reproduction or survival of the less aggressive species (Park 1962). The habitat heterogeneity hypothesis assumes that increases in the number of habitats leads to an increase in species diversity because of increased niche availability (MacArthur and MacArthur 1961, Pianka 1966). Evidence supporting either competition or habitat heterogeneity as the primary mechanisms structuring communities abounds in field experiments, nonmanipulative investigations, and theoretical models (Grant 1971, Grant 1972, Morris and Grant 1972, Hoffmeyer 1973, Price 1978, Rosenzweig 1981, Morris 1988, Abramsky et al. 1990, Eccard and Ylönen 2003, Michael et al. 2007).

Despite the numerous investigations examining small mammal community structure in grasslands throughout the United States, little research has been conducted examining small mammal communities or the mechanisms structuring small mammal communities in coastal

prairie ecosystems. Compared with other grassland systems in North America, small mammal communities within the coastal prairie have received little attention (Joule and Cameron 1975; Cameron 1977; Kincaid and Cameron 1982, 1985; Kincaid et al 1983; Spencer and Cameron 1983, 1985, 1988; Grant et al. 1985; Putera and Grant 1985; Turner and Grant 1987; Randolph and Cameron 2001).

The coastal prairie ecosystem is the southernmost unit of the tallgrass prairie biome in North America and extends along the Texas and Louisiana coast (Diamond and Smeins 1984). Climatically, the coastal prairie can be divided into upper and lower regions (Figure 8). The upper region is a wet sub-humid to humid climate while the lower region is dry sub-humid to semi-arid respectively (Thorntwaite 1948, Diamond and Smeins 1984). Along the mainland of Texas, the lower coastal prairie ends adjacent to Baffin Bay, just south of Corpus Christi. However, this ecosystem extends further south but stops along barrier islands including North Padre and South Padre islands (Figure 8; Hice and Schmidly 2002).

The mammal fauna differs between the upper and lower coastal prairie. Species adapted to humid or tall grass environments are found in both the upper and lower regions and include the northern pygmy mouse (*Baiomys taylori*), fulvous harvest mouse (*Reithrodontomys fulvescens*), marsh rice rat (*Oryzomys palustris*), and hispid cotton rat (*Sigmodon hispidus*). However, a suite of desert adapted species including the spotted ground squirrel (*Spermophilus spilosoma*), Gulf Coast kangaroo rat (*Dipodomys compactus*), and northern grasshopper mouse (*Onychomys leucogaster*) are added to mammal communities in the lower region. This unique assemblage of humid and xeric adapted species is found nowhere within the coastal prairie except on Padre Island (Chapter 1; Hice and Schmidly 2002).

Although the mammal fauna is well documented on North Padre and South Padre islands (see Chapter 1), little is known about terrestrial small mammal community structure in coastal prairies, particularly in the lower coastal prairie. Within the upper coastal prairie, coexistence of dominant species including *Baiomys taylori*, *Reithrodontomys fulvescens*, and *Sigmodon hispidus* has been attributed to habitat selection instead of competition (Joule and Cameron 1975; Cameron 1977; Kincaid and Cameron 1982, 1985; Kincaid et al 1983; Spencer and Cameron 1983, 1985, 1988; Grant et al. 1985; Putera and Grant 1985; Turner and Grant 1987; Randolph and Camron 2001). Especially within the lower region, the habitat associations of small mammals and the factors structuring communities are virtually unknown (Yzaguirre 1974, Baccus 1977, Goetze et al. 1999), and a comparable body of literature is nonexistent. Thus, the overall goal of this study was to examine small mammal community structure in the lower coastal prairie. Specific objectives were to 1) describe habitat associations of small mammal species, 2) determine how small mammals respond to the relative abundance of other species within the community, and 3) evaluate the broader patterns of species richness, diversity, and community structure.

MATERIALS AND METHODS

Study Area.—This investigation was conducted within Padre Island National Seashore (PAIS) which is located on North Padre Island, Texas (Figure 1, Figure 2). At approximately 70 miles in length, PAIS is considered the longest stretch of undeveloped barrier island in the world and traverses (north to south) Kleberg, Kenedy, and Willacy counties (National Park Service 2007). Encompassing 51,947 hectares, PAIS includes both aquatic and terrestrial environments. Vegetated environments are dominated by coastal prairie and include a mixture

of upland and wetland species. Upland species include gulf dune paspalum (*Paspalum monostachyum*), sea oats (*Uniola paniculata*), bushy bluestem (*Andropogon glomeratus*), and codgrass (*Spartina* sp.), while bulrush (*Scirpus pungens*) and cattails (*Typha domingensis*) dominate emergent marshes (Ramsey III et al. 2002; for detailed descriptions of the vegetation, see Judd et al. 1977, Drawe and Kattner 1978, Lonard et al. 1978, Drawe et al. 1981, Lonard and Judd 1980, Carls et al. 1990, Carls et al 1991, Drawe and Ortega 1996, Lonard et al. 1999, Nelson et al. 2000, Nelson et al. 2001, Ramsey III et al. 2002, Lonard et al. 2003, Lonard et al. 2004).

Mammal Sampling.--The terrestrial region of PAIS was classified into six zones and included beach, foredune, interdune, primary dune, interior, interior dune, and laguna matrix (Figure 6). With the exception of the beach, 140 standardized transects were placed within the different zones to document mammals within PAIS. Beach environments were devoid of vegetation and any species occurring in on the beach were likely to be found in adjacent foredune areas. Transects consisted of 50 Sherman folding traps (7.6 x 8.9 x 22.9 cm) spaced 4 m apart and placed along the orientation of each zone. Traps were baited each afternoon with commercial horse sweet feed (i.e. mixture of grain, corn, and molasses), checked each morning, and closed during daylight hours. Traps were set for 2 consecutive nights at each site accumulating a total of 100 trapnights from each transect. A total of 14,600 traps were set accumulating a total of 14531.5 trapnights on all transects. Closed but empty traps were accounted for by assuming that a trap was open for half the night before being tripped resulting 0.5 trapnights. Standardized trapping occurred at approximately 5-mile intervals along the length of PAIS from May to August in 2005 and 2006 (Figure 9).

Habitat Data Collection.—Habitat data were collected at five randomly selected trap stations on each transect, including vertical structure, ground cover, closed canopy height, litter depth, and soil moisture. Because the vegetation was dominated by coastal prairie and was generally less than 1.5 meters in height, the visual obstruction method was used to assess vertical structure (Robel et al. 1970). Vertical structure surrounding each trap station was estimated by taking three Robel pole measurements toward and away from the trap for a total of six measurements. Repeating this process at each of the five trap stations yielded thirty Robel pole measurements, which were averaged to estimate the vertical structure on each transect.

A Daubenmire frame was used to estimate percent ground cover surrounding each randomly selected trap stations (Daubenmire 1959). Six categorical groupings were used to describe the percent ground cover including class 1 (0-5%), 2 (5-25%), 3 (25-50%), 4 (50-75%), 5 (75-95%), and 6 (95-100%). Ground cover included grass, forb (non-grass herbs), gulf dune paspalum, sedges and rushes, standing dead, litter (non-standing dead vegetation), standing water, bare ground, and other. Ground cover was assessed on four plots at one meter intervals both along and perpendicular to the transect. This resulted in 40 cover estimates, which were averaged to estimate the ground cover for each transect. Both closed canopy height and litter depth were measured in inches at each Daubenmire frame plot. Closed canopy height was defined as the minimum plant height needed to form a closed canopy obstructing the ground from above. Thus, for each transect, forty measurements were averaged to estimate the canopy height and litter depth for each transect. Finally the soil moisture at each trap station was classified as dry, moist, wet, or saturated and was averaged

for each transect. This classification was based on a tactile evaluation of the substrate. Soils were considered dry if no moisture was detected, moist if moisture was detected but the substrate could not be molded into a shape, wet if moisture was detected and could be molded into a shape, and saturated if water was exuded when the soil was compressed by hand.

Four additional heterogeneity variables were used to describe the vegetation on transects, including vertical structure variance, canopy height variance, litter depth variance, and soil moisture variance. In addition, a habitat heterogeneity metric was created by summing all Daubenmire cover class values across a transect. Greater values for habitat heterogeneity values indicated more vegetatively diverse transects.

Habitat Associations.—Univariate and multivariate statistics were used to describe the habitat on transects where each species was captured. SPSS 10.0 for Windows was used for all statistical analyses and all statistical significance values were evaluated at an alpha level of 0.05. Mann-Whitney U tests were used to compare the means of all habitat variables on transects where a species was captured with those on transects where the species was not captured.

Principal components analysis (PCA) was used to describe the habitat on standardized transects. Variables were examined for linearity using bivariate scatter plots and were deemed suitable for multivariate ordination (McGarigal et al. 2000). Principal components were not rotated, therefore maximizing the sum of the squared factor loadings. Only principal components with eigenvalues > 1.0 were extracted. These components were then scanned for outliers using box and whisker plots (McGarigal et al. 2000). All points outside whiskers ($n = 11$) were considered outliers and removed from analyses. The

remaining data points were reanalyzed using the same procedure. Only the first two components were retained since the strongest covariation among variables are found within the first two components which were used for descriptive purposes (McCune and Grace 2002). Multivariate normality was assessed by examining skew, kurtosis, and the Kolmogorov-Smirnov normality test. Principal components were considered non-normal if skew and kurtosis values were $> |1.0|$ (McCune and Grace 2002). Factor loadings $\geq |0.5|$ were considered important to describe each principal component (McGarigal et al. 2000).

Stepwise linear regression was used to determine which of the original habitat variables contributed statistically to increased relative abundance of each species. Relative abundance was defined as the number of individuals of a particular species captured per 100 trapnights. Logistic regression was used to build models predicting species presence or absence of each species based on the original habitat variables. Species presence and absence was coded as 1 and 0 respectively. In order to prevent problems associated with multicollinearity, highly correlated variables ($r > |0.7|$) were removed from analyses which included canopy height mean, canopy height variance, and litter depth mean (Vittinghoff et al. 2005). Although logistic regression is sensitive to outliers, outliers were not removed from analyses because species captured in low relative abundance (including *B. taylori* and *R. fulvescens*) were captured on transects with extreme habitat variable values. A forward conditional stepwise approach was taken to identify the habitat variables that best predicted a species' presence or absence. The last step model was reported for each species. Each model was built using a maximum of 20 iterations before terminating and the probability for stepwise entry and removal were set at 0.05 and 0.10 respectively (Vittinghoff et al. 2005).

Interspecific Interactions.--Pairwise Spearman and partial correlations were used to determine how small mammal species responded to relative abundance of other species within the community. Partial correlations were used, controlling for all habitat variables, to remove any spurious correlations between species due to habitat selection. Nothing was controlled for to remove any influence due to latitudinal changes in species composition. Comparisons then were made between Spearman and partial correlations to determine if spurious correlations existed as a result of shared habitat selection. Specifically, three scenarios were examined. If no change occurred in the correlations sign and significance, interactions between species were considered positive or negative depending on the sign. If Spearman correlations revealed a statistical relationship but partial correlations revealed no relationship, habitat selection was considered the driving force for species associations. If Spearman correlations were positive but partial correlations were negative, it was assumed that species were selecting similar habitats but exhibited negative affects on each other. In cases of a negative relationship, discriminant function analysis (DFA) was used to examine habitat associations between species pairs using all habitat variables to determine changes in habitat selection facilitated coexistence. In order to avoid problems associated with multicollinearity, highly correlated variables ($r \geq |0.7|$) were identified using Pearson and Spearman correlations and removed from the analysis (McGarigal et al. 2000). Prior probabilities were assumed to be equal. Variables were entered stepwise in order to determine the variable(s) accounting for the most variation with the dataset. The Wilks' lambda statistic was used to enter or remove variables from the model by passing a tolerance test (probability of F : 0.05 to enter; 0.10 to remove). A chi-square transformation of the overall Wilks' Lambda was used to test for

differences in the group centroids (McGarigal et al. 2000; McCune and Grace 2002). These components were then scanned for outliers using box and whisker plots (McGarigal et al. 2000). All points outside whiskers were considered outliers and removed from analyses. The remaining data points were reanalyzed using the same procedure. Although DFA is robust to outliers, multivariate normality was assessed by examining skew, kurtosis, and the Kolmogorov-Smirnov normality test. Discriminant functions were considered non-normal if skew and kurtosis values were $> |1.0|$ (McGarigal et al. 2000, McCune and Grace 2002).

Stepwise linear regressions were used to explain increases in relative abundance based on presence or absence data for all species within the community in addition to the original habitat variables to determine the relative importance of species presence and habitat variables. Interspecific interactions (whether positive or negative) were considered more important than habitat selection if presence/absence variables accounted for more variation than habitat variables.

Community Designation.--Hierarchical cluster analysis was used to identify homogeneous subgroups of mammal assemblages by minimizing within-group variation while maximizing between-group variation (McGarigal et al. 2000). In order to avoid distortion in the dendrogram, Ward's method was used in conjunction with squared euclidean distance as the linkage and distance measure respectively (McCune and Grace 2002). Mammal relative abundance was used to create a dendrogram, which was then used to assign each of the 140 transects to a mammal cluster. Discriminant function analysis was used to maximize the difference in mammal relative abundances to best discriminate among the mammal clusters (McCune 1988). The same procedure was followed as described previously.

Small Mammal Diversity Patterns.--Linear regression was used to determine which of the original habitat variables in addition to species presence or absence were statistically responsible for increases in small mammal diversity. Diversity was measured using species richness (the total number of species) and the Shannon index (H ; $H = -\sum p_i \ln[p_i]$ where H is Shannon diversity and $\sum p_i \ln[p_i]$ is the sum of the proportion of the i th species multiplied by the natural log of the proportion of the i th species; Shannon and Weaver 1949). The Shannon index was used because it has been shown to perform well when species assemblages are small (i.e. less than 25; Magnussen and Boyle 1995; Mouillot and Leprêtre 1999). Alpha diversity (α) and gamma diversity (γ) were assessed on each transect and across all transects using both metrics while beta diversity (β) was derived using the additive equation, $\gamma = \alpha + \beta$ (MacArthur et al. 1996; Lande 1996). Lande (1996) advocated partitioning diversity additively so diversity and its components would be in the same units and therefore comparable. Additive versions treat α and β as the average within-sample diversity and the average amount of diversity not found in a sample respectively while gamma diversity is the total diversity across all samples (Veech et al. 2002). Additive models also remove the possibility of undefined mathematical equations. In any multiplicative model where alpha diversity is in the denominator (e.g. Whittaker 1960), the quotient is undefined when alpha diversity is zero. Using the Shannon index, any transect with a richness of 1 would result in an alpha diversity of zero. Because only a single species was captured on many transects ($n = 50$), a multiplicative model would have resulted an undefined beta diversity for 36% of all transects.

RESULTS

Habitat Associations.--Principal components 1 and 2 were retained for descriptive purposes and accounted for 37.198% of the total variation from the original variables. Both components were considered normal based on skew and kurtosis values ($< |1.0|$) and the Kolmogorov-Smirnov normality test ($P > 0.05$). On component 1, (eigenvalue [EV] = 4.059, 23.879% of total variation) high positive factor loadings (> 0.5) included (from greatest to least) canopy height mean, vertical structure mean, litter depth mean, grass cover, and canopy cover variance. High negative factor loadings (< -0.5) included bare ground cover. Component 1 represented a grass cover and height gradient where negative values represented transects with bare ground and positive values represented transects tall dense grass cover with deep litter layers. On component 2, (EV = 2.264, 13.319% of variation) high positive factor loadings included standing dead cover, forb cover, and litter cover. High negative factor loadings included soil moisture mean and soil moisture variance. Component 2 represented an aridity gradient where positive values represented transects with xeric vegetation and negative transects represented transects found in mesic areas. A scatter plot of components 1 and 2 revealed a wide array of habitat types (Figure 10).

Spermophilus spilosoma. Six spotted ground squirrels were captured from five transects. Litter cover was greater and soil moisture mean was lower on transects where *S. spilosoma* was captured (APPENDIX XXIII). A scatter plot of principal components 1 and 2 revealed that relative abundance was influenced negatively by grass cover and height (component 1) and positively by aridity (component 2; APPENDIX XXIV). Litter cover was the only significant variable determining relative abundance or presence of *S. spilosoma* (Table 4).

Dipodomys compactus- One hundred fifty-two Gulf-coast kangaroo rats were captured from forty-three transects. Bare ground cover and vertical structure variance were greater and grass cover, gulf dune paspalum cover, sedge and rush cover, canopy height mean, vertical structure mean, and soil moisture variance were lower on transects where *D. compactus* was captured (APPENDIX XXV). A scatter plot of principal components 1 and 2 revealed that relative abundance was influenced negatively by grass cover and height and positively by aridity (APPENDIX XXVI). Bare ground cover and northing were the most important variables determining relative abundance, while gulf dune paspalum cover, litter cover, bare ground cover, and northing were the most important variables determining presence (Table 4).

Baiomys taylori- Nineteen northern pygmy mice were captured on thirteen transects. On transects where *B. taylori* was captured there was greater sedge and rush cover, canopy height mean and variance, litter depth mean and variance, vertical structure mean, and soil moisture mean and variance, and lower litter cover and bare ground cover (APPENDIX XXVII). A scatter plot of principal components 1 and 2 revealed that relative abundance was influenced positively by grass cover and height and was influenced negatively to a slight degree by aridity (APPENDIX XXVIII). Litter depth mean, northing, and bare ground cover were the most important variables determining relative abundance, while litter cover, bare ground cover, litter depth mean, and northing were important variables determining presence (Table 4).

Reithrodontomys fulvescens- Nineteen fulvous harvest mice were captured from thirteen transects. Grass cover, gulf dune paspalum cover, canopy height mean, litter depth mean and variance, vertical structure mean, and soil moisture variance were greater and bare

ground cover and other cover were lower on transects where *R. fulvescens* were captured (APPENDIX XXIX). A scatter plot of principal components 1 and 2 revealed that relative abundance was influenced positively by grass cover and height and neutrally by aridity (APPENDIX XXX). Litter depth mean, northing, and bare ground cover were the most important variables determining relative abundance, while bare ground cover, litter depth mean, and northing were the most important variables determining presence (Table 4).

Onychomys leucogaster- Fourteen northern grasshopper mice were captured from nine transects. Gulf dune paspalum cover was statistically lower on transects where northern grasshopper mice were captured (APPENDIX XXXI). A scatter plot of principal components 1 and 2 revealed that relative abundance was negatively influenced by grass cover and height and negatively to a slight degree by aridity (APPENDIX XXXII). Northing and other cover were the most important variables determining relative abundance, while northing and forb cover were the most important variables determining presence (Table 4).

Oryzomys palustris- Four marsh rice rats were captured from three transects. Sedge and rush cover and water cover, and soil moisture mean were greater on transects where marsh rice rats were captured (APPENDIX XXXIII). A scatter plot of principal components 1 and 2 revealed that relative abundance was influenced positively by vegetative structure and negatively by aridity (APPENDIX XXXIV). Soil moisture mean was the only variable determining relative abundance, while sedge and rush cover was the only variable determining presence (Table 4).

Sigmodon hispidus- Ninety-three hispid cotton rats were captured on thirty-six transects. Canopy height mean and variance, litter depth mean and variance, vertical structure

mean and variance, and soil moisture variance were greater while gulf dune paspalum cover and bare ground cover were lower on transects where *S. hispidus* was captured (APPENDIX XXXV). A scatter plot of components 1 and 2 revealed that relative abundance was influenced positively by grass cover and height and negatively by aridity (APPENDIX XXXVI). Northing, vertical structure mean, and gulf dune paspalum cover were the most important variables determining relative abundance, while standing dead cover, other cover, vertical structure mean, and northing were the most important variables determining presence (Table 4).

Mus musculus- Nine house mice were captured from 6 transects. Vertical structure variance was greater and gulf dune paspalum cover was lower on transects where house mice were captured (APPENDIX XXXVII). A scatter plot of components 1 and 2 revealed that relative abundance was influenced positively the grass cover and height gradient and slightly positively on the aridity gradient (APPENDIX XXXVIII). Northing and vertical structure variance were the most important variables determining relative abundance, while northing was the only variable determining presence (Table 4).

Interspecific Interactions.--Spurious correlations were found between seven species pairs (Table 5). Comparisons between *D. compactus* and *R. fulvescens*, *D. compactus* and *O. leucogaster*, *D. compactus* and *M. musculus*, *S. hispidus* and *O. leucogaster*, and *S. hispidus* and *M. musculus* were statistically significant using Spearman correlations but not partial correlations. Comparisons between *S. spilosoma* and *M. musculus* were statistically significant using partial correlations but not Spearman correlations. Correlations between *D. compactus* and *R. fulvescens* were statistically negative using Spearman correlations but no relationship was found based on partial correlations. Correlations between *B. taylori* and *R.*

fulvescens and *O. leucogaster* and *M. musculus* did not change between tests. Furthermore, species presence was important to *B. taylori*, *R. fulvescens*, *O. leucogaster*, and *M. musculus* relative abundance models and accounted for more variation than habitat variables in 3 out of 4 models (Table 6).

Correlations between *R. fulvescens* and *S. hispidus* were positive using Spearman and negative using partial correlations. Discriminant functions were considered normal based on skew and kurtosis values ($< |1.0|$) and the Kolmogorov-Smirnov normality test ($P < 0.05$). Litter depth mean was the best variable discriminating between transects where either species was captured; however, both species were captured together on seven transects. A scatter plot of discriminant functions 1 and 2 revealed *R. fulvescens* and *S. hispidus* were captured syntopically on transects with dense vegetation and deep litter layers (grass cover) and allotopically on transects with more open drafty vegetation (sedge and rush cover).

Community Designation.--Hierarchical cluster analysis identified nine mammal clusters based on relative abundance of the eight species. DFA extracted four discriminant functions, which were used to clarify the differences among mammal clusters (Table 7; Wilks' lambda = 0.001, $\chi^2 = 865.113$, $df = 40$, $P = 1.4 \times 10^{-155}$). Little overlap existed among mammal clusters on the scatter plot of canonical scores from functions 1 and 2 indicating a high degree of separability, which was also supported by a highly statistically significant Wilks' lambda value (Figure 11). The high percentage (99.3%) of the original groups correctly classified further support this difference. Stepwise analyses revealed relative abundance of *D. compactus*, *S. hispidus*, *R. fulvescens*, and *S. pilosoma* (in decreasing order of importance) as the best variables discriminating among mammal clusters. Positive and negative canonical scores on

function 1 represent increases in relative abundance of *D. compactus* and *S. hispidus* respectively. Relative abundance of *S. hispidus* had the single greatest positive correlation with function 2 (Figure 11). Although nine clusters were identified, a two-branch pattern was formed. One branch included four clusters that were dominated by tall grass adapted species (*B. taylori*, *R. fulvescens*, *O. palustris*, *S. hispidus*, and *M. musculus*). The other species branch was dominated by desert-adapted species (*S. spilosoma*, *D. compactus*, and *O. leucogaster*) (Figure 11, Table 8).

Small Mammal Diversity Patterns.--Stepwise linear regression based on habitat variables and northing revealed northing, vertical structure mean, bare ground cover, litter depth mean, and gulf dune paspalum cover as the variables contributing to increased α_{Richness} (Table 9). Northing and litter depth mean were the only variables contributing to increased α_H . When species presence/absence was included along with habitat variables, stepwise linear regression models revealed the presence of *M. musculus* as the best predictor of increases in diversity (Table 10). The mean α_{richness} on transects (0.89 ± 0.16) was statistically less ($Z = -12.50$, $P = 7.00 \times 10^{-146}$) than the mean β_{richness} (7.11 ± 0.16) and the α_H (0.28 ± 0.09) was statistically less ($Z = -10.03$, $p = 1.16 \times 10^{-35}$) than the mean β_H on all transects (1.13 ± 0.09).

DISCUSSION

The mechanism structuring coastal prairie small mammal communities has generally been attributed to habitat selection rather than competition or other factors (Joule and Cameron 1975; Cameron 1977; Kincaid and Cameron 1982; Kincaid et al 1983; Spencer and Cameron 1985, 1988; Grant et al. 1985; Turner and Grant 1987). In contrast, results of this study indicate that community structure of small mammals in lower coastal prairie was a result

of habitat selection, positive interspecific interactions, and interference competition. The formation of two species assemblages dominated by either tall grass or desert adapted species indicate that habitat selection was the overriding mechanism responsible for structuring mammal communities within PAIS. Support for this tall grass/desert grassland division was evident based on the habitat descriptions for each of the species (see PCA scatter plots for each individual species, Appendices E-L). Within both assemblages, habitat selection was the most important factor determining relative abundance for numerically dominant species (*D. compactus* and *S. hispidus*) and rare species (*S. pilosoma* and *O. palustris*) within both assemblages. Furthermore, habitat selection explained spurious correlations in five species pairs (Table 5).

Although habitat selection was the overarching mechanism structuring small mammal communities, the role of interspecific interactions as a driving force for community structure cannot be discounted. Within both species assemblages, interspecific interactions were important for numerically subdominant species. Correlations between *B. taylori* and *R. fulvescens* and *O. leucogaster* and *M. musculus* remained statistically positive even after controlled for habitat variables (Table 5). For these species, presence/absence variables contributed statistically to increased relative abundance and accounted for more variation than all habitat variables for three of the four species (Table 6). Negative interactions only were found between *R. fulvescens* and *S. hispidus*. Although both species selected similar habitats, partial correlations revealed a negative relationship between these species. It is likely that interference competition is structuring this pattern rather than resource competition. A scatter plot of discriminant functions 1 and 2 indicated that these species were never captured

together on transects with less dense vegetation, but were only captured together on transects with dense vegetation and deep litter layers. In controlled experiments, Putera and Grant (1985) observed interactions between *S. hispidus* and *R. fulvescens* with and without vegetation. Aggressive behavior in *S. hispidus* toward *R. fulvescens* was only observed when both species came into contact in areas without vegetation. Similarly, Terman (1974) examined interactions between *S. hispidus* and *Microtus ochrogaster*. *S. hispidus* exhibited behavioral dominance over *M. ochrogaster* and excluded the latter from areas with less vegetative cover but not areas with dense vegetative cover. It is likely that within the lower coastal prairie that *S. hispidus* is behaviorally dominant over *R. fulvescens*. On transects with dense vegetation and deep litter layers, individuals can occupy home ranges in close proximity yet remain undetected by opposing species thereby facilitating coexistence.

With the exception of rare species, habitat selection was more important than interspecific interactions for increases in relative abundance of numerically dominant species (*D. compactus* and *S. hispidus*). Conversely, interspecific interactions were more important than habitat selection for increases in relative abundance of numerically sub-dominant species. These mechanistic differences in structure of dominant and subdominant species are expected. Dominant species within a community are more likely to be limited by resource availability and are less likely to be regulated by interspecific interactions (Morris 1988, Huitu et al. 2006). Habitat variables are therefore expected to have a greater impact on relative abundance of dominant species as opposed to presence/absence of conspecifics, which is supported by the results of this study. In communities saturated with dominant species, or when the abundance of dominant species is much greater than the abundance of subdominant

species, relative abundance of subdominant species is more likely to be regulated by dominant species either directly (interference competition) or indirectly (exploitative competition) and species persistence is intertwined with that of other species. Interspecific interactions or presence/absence variables are therefore expected to have the greatest impact on relative abundance on subdominant species in comparison to habitat variables, which is supported by the results of this study.

Despite the relative importance of habitat selection and interspecific interactions to the overall community structure, the importance of the exotic *M. musculus* to diversity was much greater than other species. The presence of this species also was a better predictor of diversity than any habitat model. The alien *M. musculus* was only captured on transects with greatest species richness, and it was captured on five of the six most diverse (H) transects. Traditionally, it has been hypothesized that invasibility is negatively correlated with ecosystem diversity as a result of decreasing resource availability with increasing diversity (Elton 1958, Tillman 1999). However, an emerging body of literature suggests that native species diversity and invasibility are positively correlated (Stohlgren et al. 2003). Positive correlations between native and non-native species have been documented for microbes (Jiang and Morin 2004) and birds (Stohlgren et al. 2006) but an overwhelming majority of studies describing this pattern have been reported for plants (e.g. Levine 2000, Sax 2002, Stohlgren et al. 2003, Stohlgren et al. 2006). This is the first time this pattern, where the 'rich get richer' (Stohlgren et al. 2003), has been reported for mammals.

Independent of mammalian interactions, nothing had the greatest contribution to both diversity models. Transects at the southern end of PAIS had the greatest α_{richness} and α_H . Of

the eight transects with species richness ≥ 3 , seven were adjacent to Mansfield Channel at the southernmost border of the study area (Figure 2). Of the six transects with Shannon diversity values ≥ 1.0 , five were adjacent to Mansfield Channel. When examining the species accumulation curve, the distance and effort required to capture all species was much less moving south to north (15 km; $n = 3079.5$ trapnights) than it was moving north to south (103 km; $n = 13,139.5$ trapnights; Figure 12). Furthermore, the addition of desert adapted species to coastal prairie mammal communities only occurs at its southern extent. Even on North Padre Island at the southern limit of the coastal prairie, desert adapted species were more common at the southern extreme of the island. This pattern is linked to the vegetation patterns on North Padre Island and is ultimately governed by precipitation. Reed et al. (2006) suggested that declines in species richness were associated with increased litter, which resulted from increased precipitation. Within Texas, a precipitation gradient exists where rain in the south is less than rain in the north, and this gradient is reflected in the vegetation communities. As a general rule, vegetation on Padre Island is taller and denser with deeper litter layers in the north than in the south. Southern portions of North Padre Island resembled desert grassland ecosystems whereas northern portions resembled tall grass prairies and included species such as big blue stem (*Andropogon gerardii*). This change in vegetative structure is likely to have limited the northern range of many desert adapted species. *O. leucogaster* was only documented at the southern end of North Padre Island and although *S. pilosoma* and *D. compactus* were present along the length of North Padre Island, their northern distributions were restricted to areas adjacent to the beach where wind and waves disturbed the vegetation creating areas of bare sand. It is likely that this increased density in vegetation prevents

species from persisting by restricting movement especially for desert adapted species that require more bare ground.

Finally, β_{richness} was nearly 8 times greater on transects than α_{richness} while β_H was nearly 4 times greater than α_H indicating a relative impoverished faunas found on transects. Compared to other grassland ecosystems, average α was considerably less within the lower coastal prairie than other grassland types within North America (Grant and Birney 1979). This disparity between α and β is likely a result of two factors. First, the mammal community was divided into two assemblages containing three desert adapted species and five tall grass adapted species. This division of richness into two assemblages effectively reduced the likelihood of capturing multiple species from opposing assemblages. Indeed, native species composition on each transect was dominated by species in one assemblage and never contained more than one species from the opposing assemblage. These assemblages therefore served as effective barriers to invasion by native species from an opposing assemblage. Furthermore, the maximum number of species from either assemblage were never captured simultaneously on a transect. Second, although Padre Island is the most speciose barrier island along the coast of Texas, barrier islands are relatively depauperate when compared to mainland fauna (Hice and Schmidly 2002). With fewer species in the species pool, it is likely that niche breadth will be larger, resulting in fewer species with any given area. Given wider niche breadth, negative interspecific interactions are less likely to structure species assemblages, which is consistent with the results of this study.

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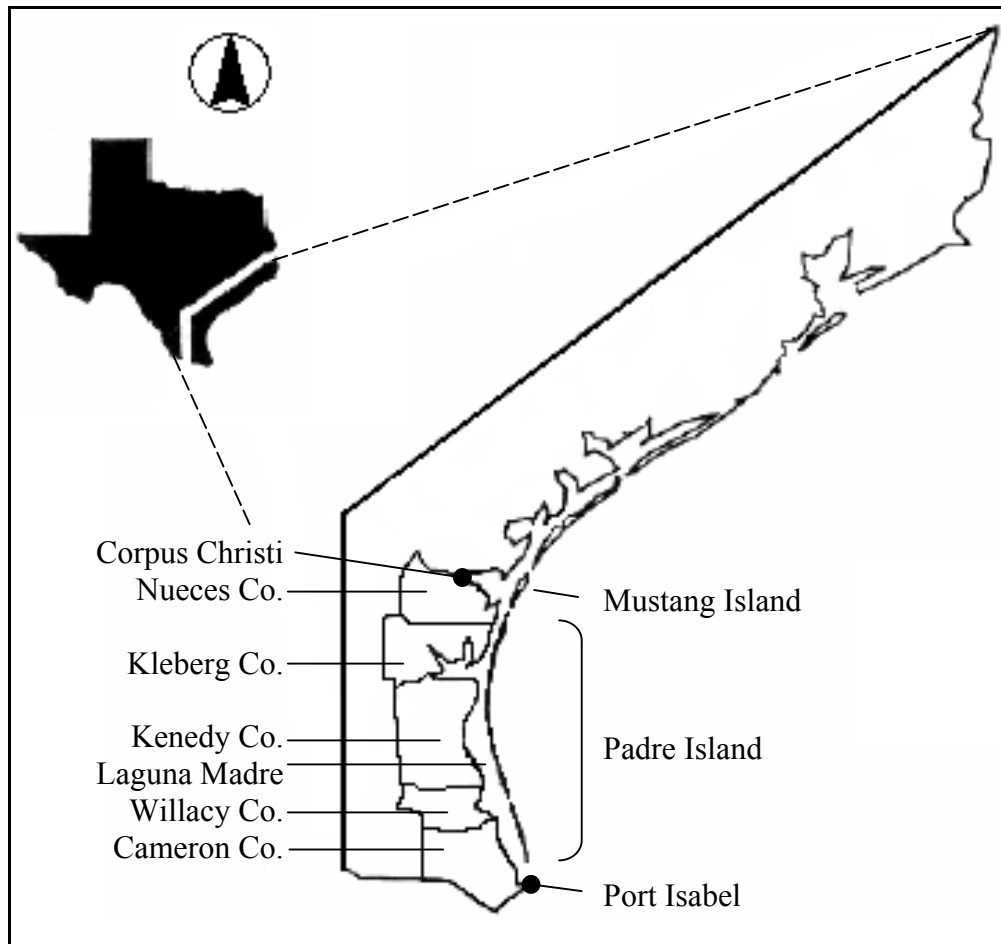


Figure 1. Coastal counties surrounding Mustang and Padre islands (modified from Schmidly 2004).



Figure 2. Map of South Texas including place names used to describe boundaries and locality records for mammals.



Figure 3. Packery Channel (solid line) is the current boundary between Mustang and North Padre Island. This channel follows part of the original boundary, Corpus Christi Pass (dashed line).

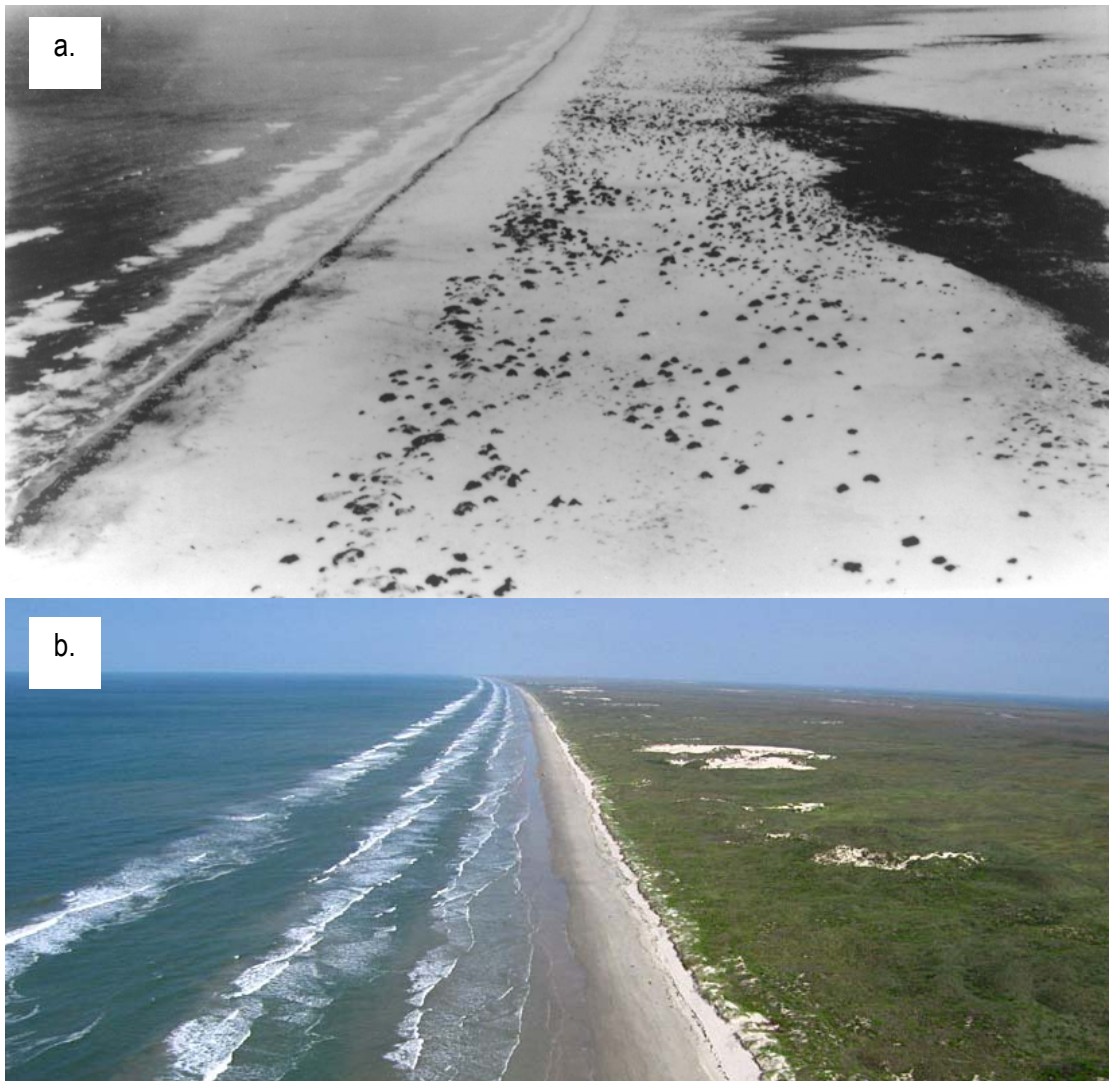


Figure 4. Comparison of vegetation from similar areas of North Padre Island between circa 1950 (a; Padre Island National Seashore Archives) and 2005 (b; reproduced with permission from Aber 2005).

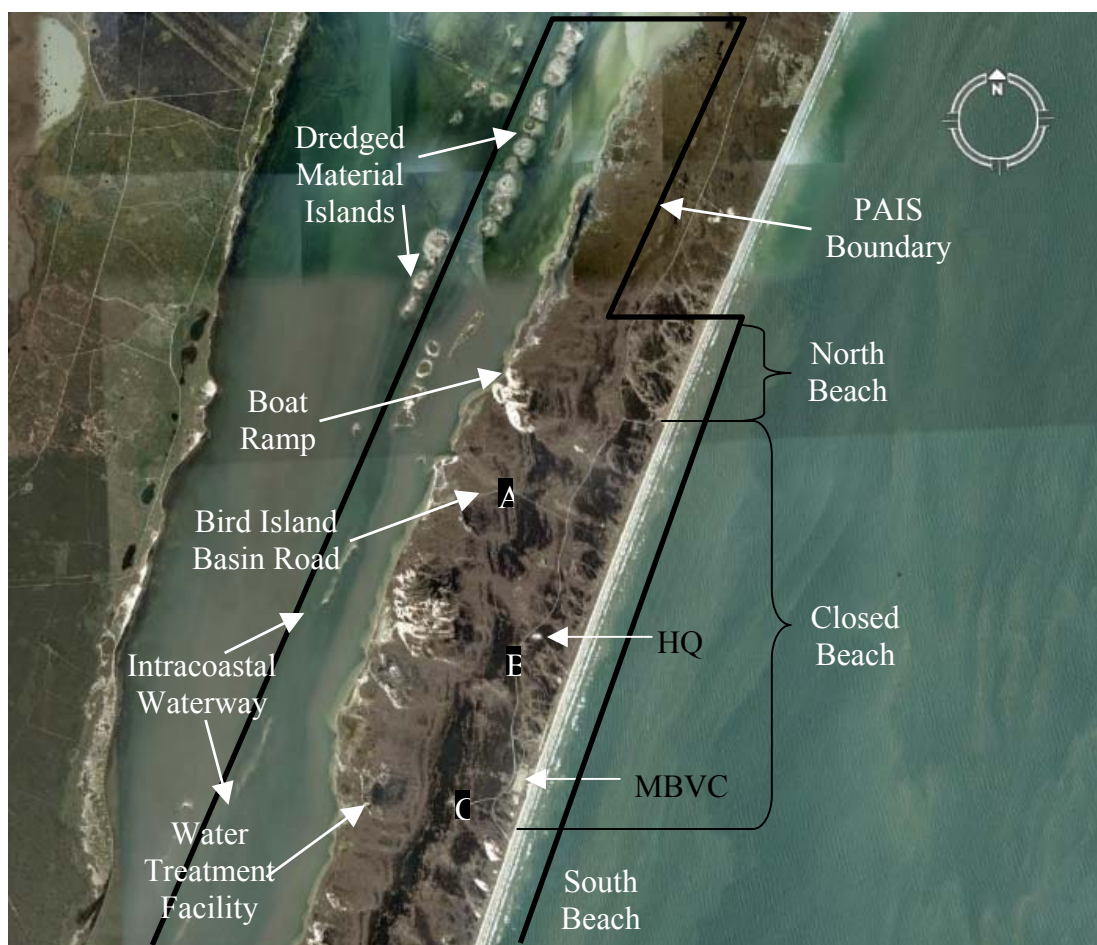


Figure 5. Important place names in northern PAIS used to describe current and historical localities. Abbreviations include, HQ- PAIS headquarters, MBVC- Malaquite Beach Visitor Center, and A, B, and C refer to ponds A, B, and C respectively.

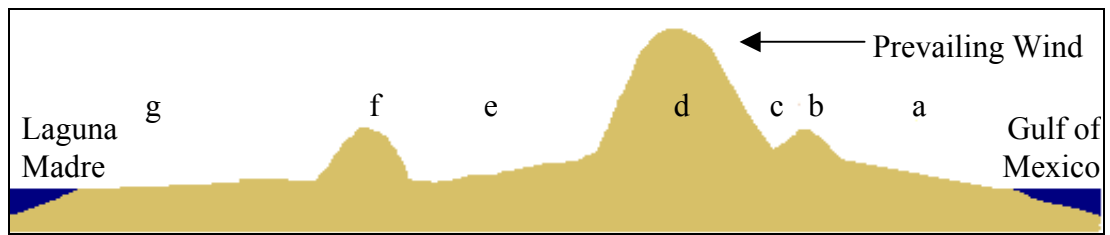


Figure 6. Cross-section of North Padre Island. Terrestrial classification zones were classified as beach (a), foredune (b), interdune (c), primary dune (d), interior (e), interior dune (f), and laguna matrix (g).

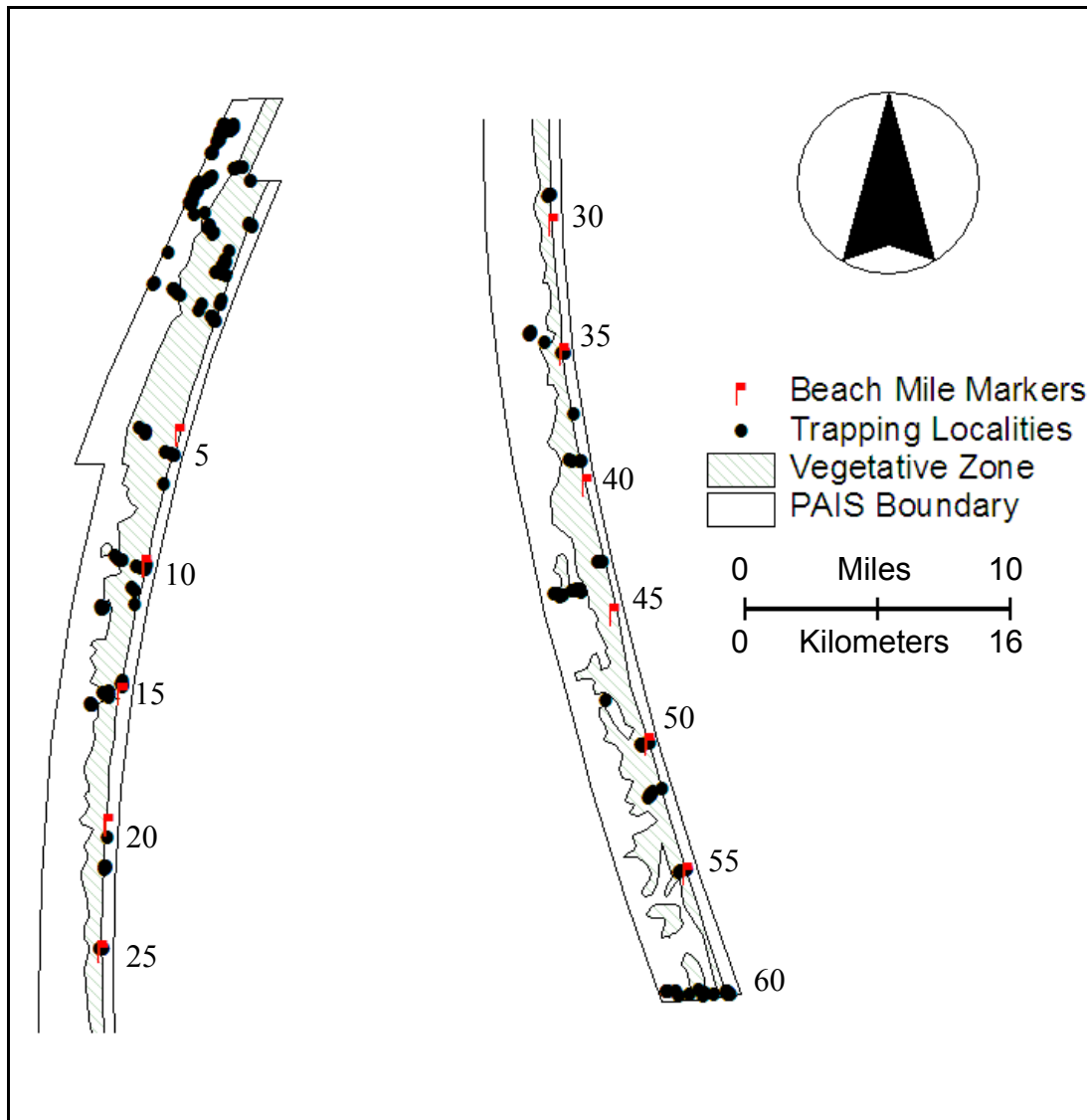


Figure 7. Locations of all standardized and non-standardized transects set during this study. Padre Island National Seashore was broken into two sections. The section on the left represents trapping localities from the northern park boundary south to beach mile 28.5. The section on the right represents trapping localities from approximately beach mile 28.5 to Mansfield Channel.

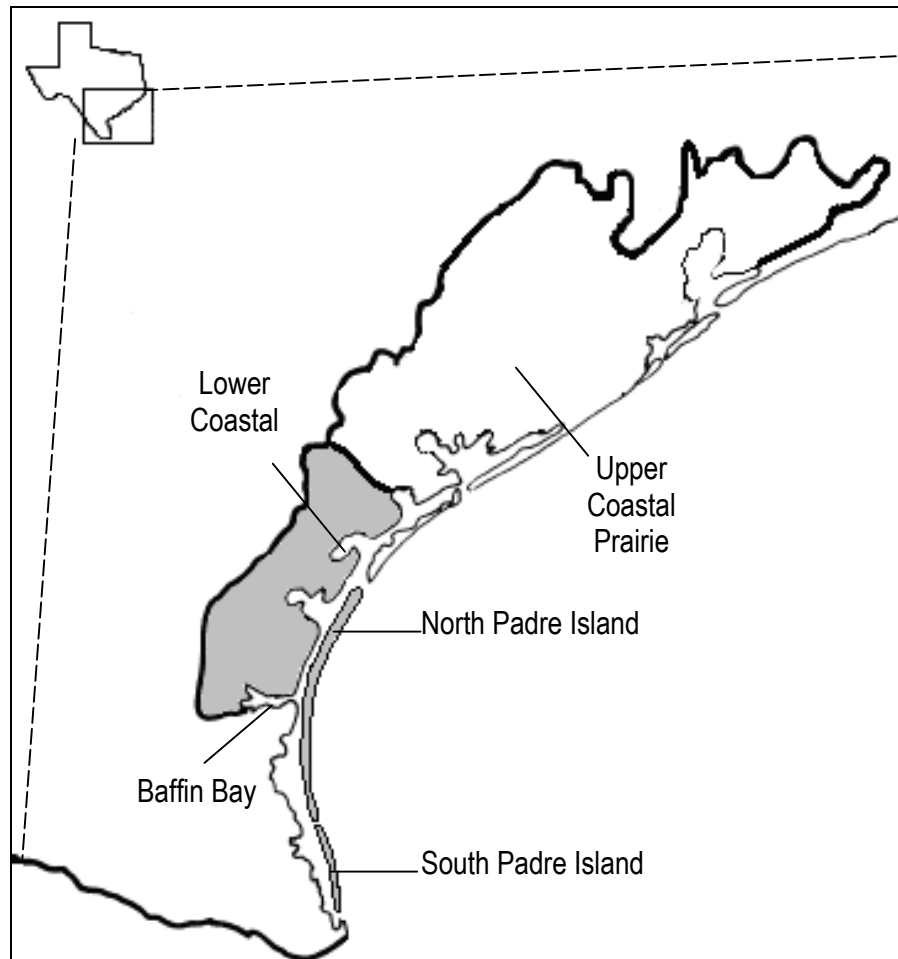


Figure 8. Division of the upper and lower coastal prairie in Texas (modified from Diamond and Smeins 1984).

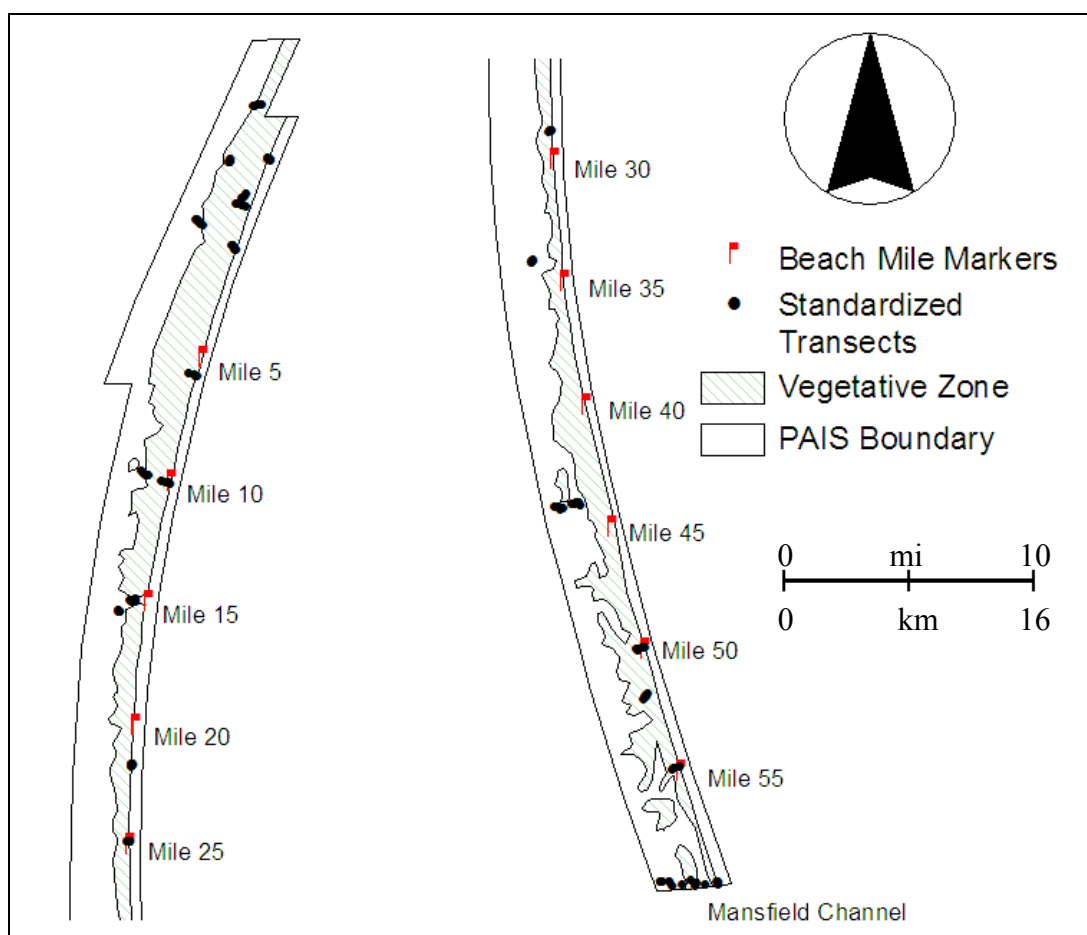


Figure 9. Locations of 140 standardized transects on Padre Island National Seashore (PAIS). The left and right sides of this figure represent north and south halves of PAIS. Beach mile markers were used within the park and were distance south on the beach from the end of paved road.

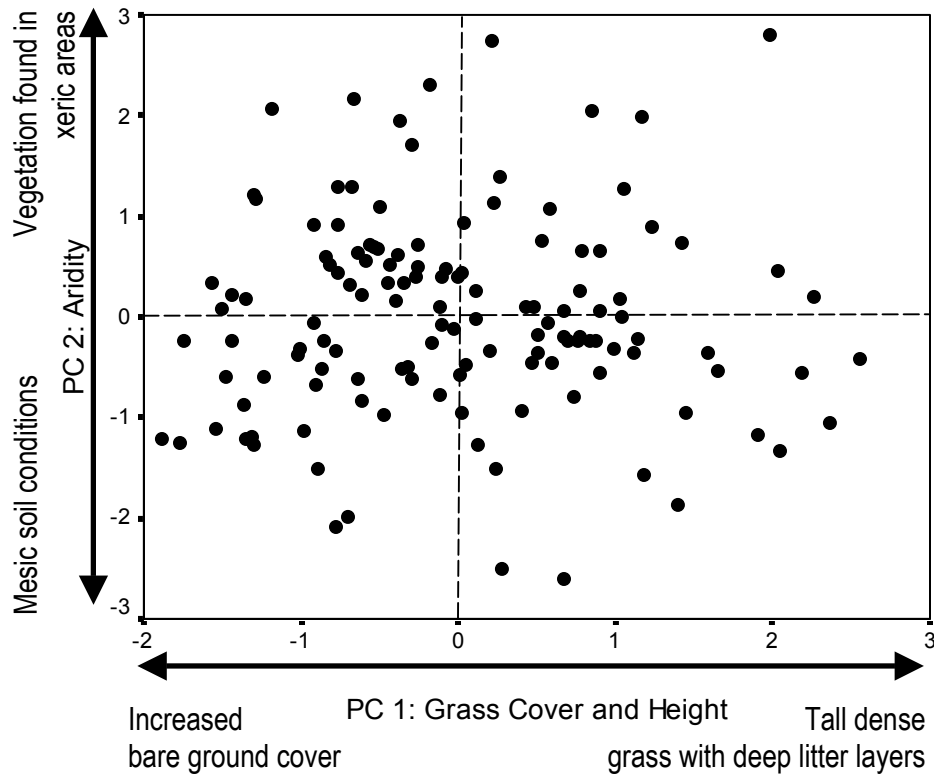


Figure 10. Habitat summary of 129 standardized transects (dots) within Padre Island National Seashore. Principal component 1 represents a grass cover and height gradient while component 2 represents an aridity gradient. Dashed lines represent component scores of 0.

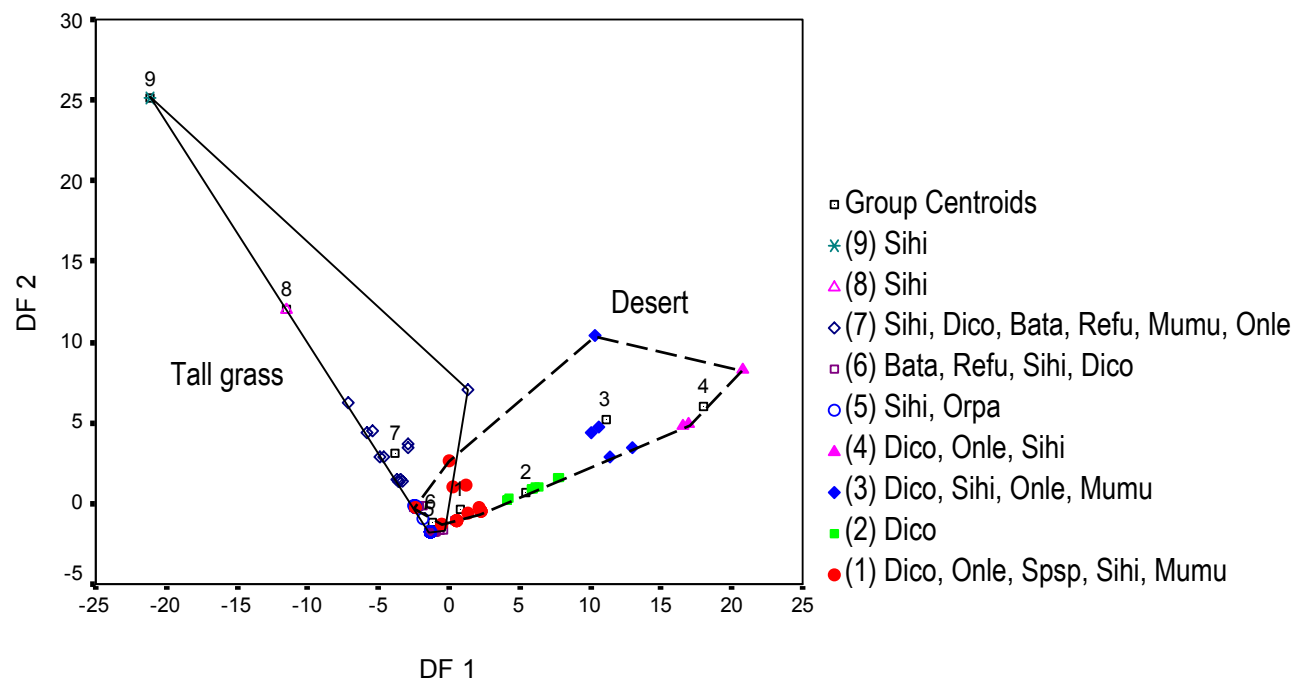


Figure 11. Nine mammal clusters formed two soecues branches that were dominated by tall grass (solid line) and desert (dashed line) adapted species. Within each cluster, species present within each cluster were presented in descending numerical importance. Species abbreviations include: Spssp = *Spermophilus spilosoma*, Dico = *Dipodomys compactus*, Bata = *Baiomys taylori*, Refu = *Reithrodontomys fulvescens*, Onle = *Onychomys leucogaster*, Orpa = *Oryzomys palustris*, Sihi = *Sigmodon hispidus*, and Mumu = *Mus musculus*.

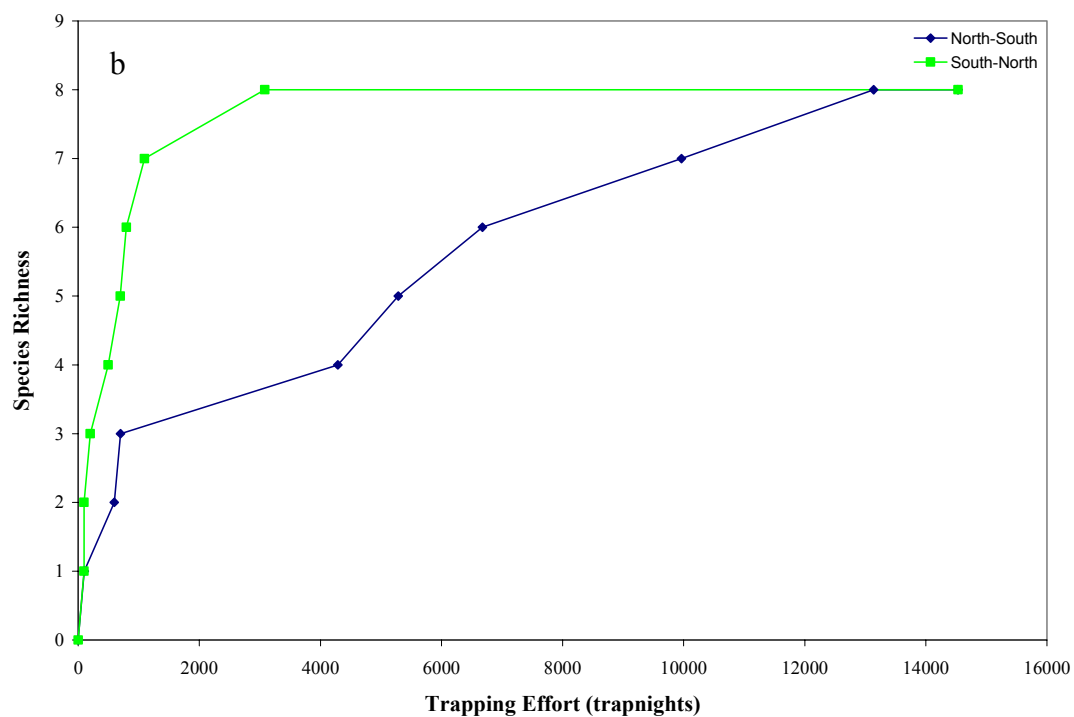
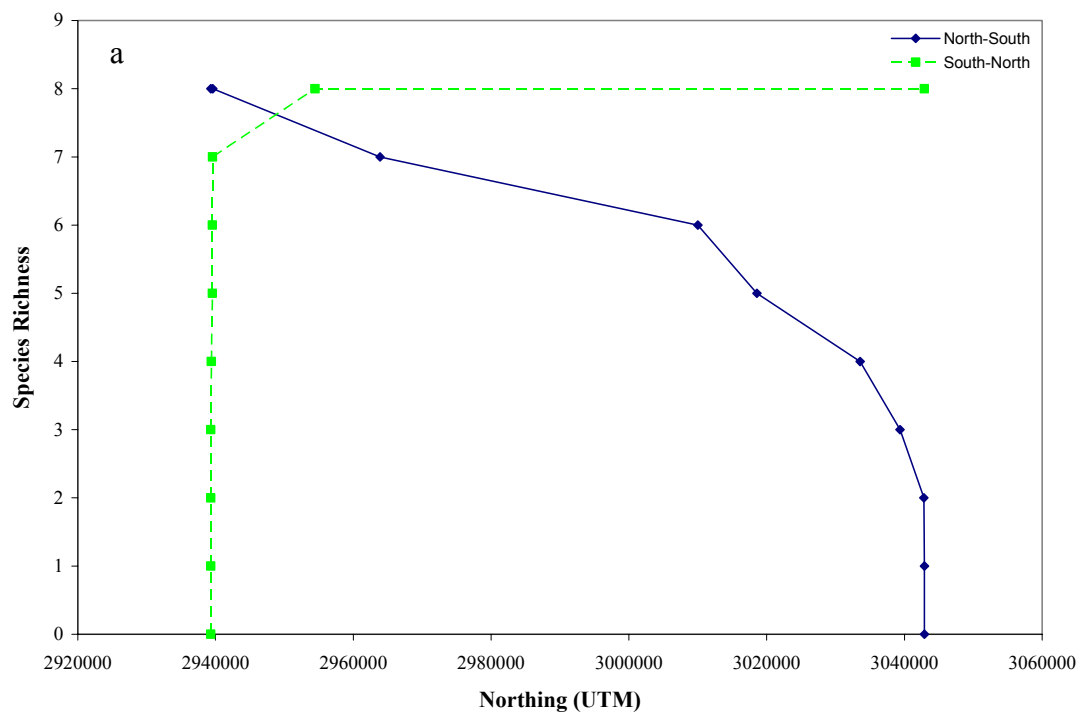


Figure 12. Species accumulation curves based on Northing (a) and effort (b). Diamonds and squares indicate the accumulation of species moving north to south and south to north respectively.

Table 1. Bat mist-netting effort within PAIS from 2005-2007.

Date	Locality	Habitat	Northing	Easting	Mist net Hours
26 June 2005	7.07 Mi North, 9.09 Mi East, El Martillo	Water	3036650	668049	4.00
27 June 2005	8.56 Mi North, 8.75 Mi East, El Martillo	Black Willow	3039002	667474	2.00
1 July 2005	7.24 Mi North, 9.25 Mi East, El Martillo	Structure	3037060	668317	2.53
21 July 2005	5.62 Mi North, 8.40 Mi East, El Martillo	Water	3034317	666885	2.00
18 May 2006	8.07 Mi North, 9.13 Mi East, El Martillo	Water	3039319	668073	4.00
19 May 2006	8.56 Mi North, 8.75 Mi East, El Martillo	Black Willow	3039002	667474	4.00
20 May 2006	8.56 Mi North, 8.75 Mi East, El Martillo	Black Willow	3039002	667474	4.00
21 May 2006	10.19 Mi North, 10.00 Mi East, El Martillo	Black Willow	3041711	669485	4.00
22 May 2006	6.31 Mi North, 7.32 Mi East, El Martillo	Black Willow	3034403	666051	4.24
9 June 2006	9.50 Mi South, 27.24 Mi East, Armstrong	Water	2963510	664180	0.00
12 September 2006	5.62 Mi North, 9.02 Mi East, El Martillo	Structure	3034343	668008	0.00
20 September 2006	5.62 Mi North, 9.02 Mi East, El Martillo	Structure	3034343	668008	0.00
23 September 2006	5.83 Mi North, 9.22 Mi East, El Martillo	Structure	3034569	668125	0.00
25 September 2006	5.83 Mi North, 9.22 Mi East, El Martillo	Structure	3034569	668125	4.90
10 October 2006	5.62 Mi North, 9.02 Mi East, El Martillo	Structure	3034343	668008	8.27
30 October 2006	5.62 Mi North, 9.02 Mi East, El Martillo	Structure	3034343	668008	11.53
Total					55.47

Table 2. Trapping effort and results of mammal surveys on 14 small islands in the Laguna Madre. Two islands (ROV and SAC) did not have names and were given random three letter names. Two small mammal species were captured, which included the marsh rice rat (*Oryzomys palustris*; Orpa) and hispid cotton rat (*Sigmodon hispidus*; Sihi). Five additional species were documented through observations and included the Texas pocket gopher (*Geomys personatus*; Gepe), gray fox (*Urocyon cinereoargenteus*; Urci), coyote (*Canis latrans*; Cala), northern raccoon (*Procyon lotor*; Prlo), and white-tailed deer (*Odocoileus virginianus*; Odvi).

Island	easting	northing	Traps set	Trapnights	Trapped			Observed			
					Orpa	Sihi	Gepe	Urci	Cala	Prlo	Odvi
DMI 95	668294	3045443	600	592	4	0	0	0	1	1	1
North Bird Island	668793	3045247	900	896	40	0	0	0	0	1	0
DMI 97	668150	3045070	600	597	2	0	0	0	0	1	1
DMI 99	667975	3044812	1200	1187.5	1	0	0	0	1	1	1
DMI 101	667908	3044475	600	594.5	2	0	0	0	0	1	1
DMI 103	667585	3043774	160	160	4	0	0	0	0	1	0
South Bird Island	667309	3042136	500	491	3	8	0	0	0	1	1
DMI 111	666663	3041781	699	690.5	1	130	1	0	1	1	0
DMI 113	666515	3041454	700	696.5	0	43	0	1	1	1	0
DMI 115	666350	3041034	300	298	0	4	0	0	1	1	0
DMI 117	666173	3040638	939	937.5	2	2	0	0	1	1	0
SAC Island	666481	3039975	150	149.5	9	0	0	0	0	0	0
ROV Island	664807	3037602	200	189.5	0	0	0	0	0	0	0
Rock Island	663871	3035579	600	598.5	0	0	0	0	0	0	0
Total			8148	8078	68	187	1	1	6	11	5

Table 3. Color morphs of the Gulf Coast kangaroo rat vary considerably among populations on barrier islands in the Gulf of Mexico. The disparity in the proportions of ochraceous buff to cartridge buff observed on North Padre Island during this study (2005-2007) was the greatest reported in the literature. Proportions other than those in this study are from Baumgardner and Schmidly (1981).

	2005- 2007	North Padre Island	Mustang Island	South Padre Island	Tamaulipas
Ochraceous	4.7	34.7	82.8	6.7	94.4
Cartridge	95.4	65.3	17.2	93.3	5.6

Table 4. Habitat associations of small mammals on Padre Island National Seashore based linear and logistic regression models. Species abbreviations include: Spsp = *Spermophilus spilosoma*, Dico = *Dipodomys compactus*, Bata = *Baiomys taylori*, Refu = *Reithrodontomys fulvescens*, Onle = *Onychomys leucogaster*, Orpa = *Oryzomys palustris*, Sihi = *Sigmodon hispidus*, and Mumu = *Mus musculus*). Variable abbreviations include: BGC = bare ground cover, FC = forb cover, GDPC = gulf dune paspalum cover, LC = litter cover, LDM = litter depth mean, N = northing, OC = other cover, RPM = Robel pole mean, RPV = Robel Pole variance, SDC = standing dead cover, SMM = soil moisture mean, SRC = sedge and rush cover. The test statistic for the linear and logistic regression models are F and χ^2 respectively. Performance for logistic regression models was based on Nagelkerke r^2 values.

	Species	Model Summary	R^2	Test Statistic	df	P
linear regression	Spsp	$-0.198 + 0.206[\text{LC}]$	0.042	6.06	139	0.015
	Dico	$46.421 + 0.539[\text{BGC}] - 1.57 \times 10^{-5}[\text{N}]$	0.183	15.336	139	< 0.001
	Bata	$10.662 + 0.107[\text{LDM}] - 3.48 \times 10^{-6}[\text{N}] - 6.50 \times 10^{-2}[\text{BGC}]$	0.149	7.96	139	< 0.001
	Refu	$7.880 + 0.168[\text{LDM}] - 2.56 \times 10^{-6}[\text{N}] - 6.71 \times 10^{-2}[\text{BGC}]$	0.213	12.242	139	< 0.001
	Onle	$9.655 - 3.25 \times 10^{-6}[\text{N}] + 0.166[\text{OC}]$	0.128	10.087	139	< 0.001
	Orpa	$-6.93 \times 10^{-2} + 5.852 \times 10^{-2}[\text{SMM}]$	0.059	8.721	139	0.004
	Sihi	$39.456 - 1.315 \times 10^{-5}[\text{N}] + 0.109[\text{RPM}] - 0.653[\text{GDPC}]$	0.222	12.911	139	< 0.001
	Mumu	$6.430 - 2.15 \times 10^{-6}[\text{N}] + 1.40 \times 10^{-3}[\text{RPV}]$	0.137	10.906	139	< 0.001

logistic regression	Spsp	$-6.881 + 2.831[\text{LC}]$	0.108	4.05	1	0.044
	Dico	$33.558 - 1.192[\text{GDPC}] + 1.846[\text{LC}] + 0.919[\text{BGC}] - 1.26 \times 10^{-5}[\text{N}]$	0.474	56.955	4	< 0.001
	Bata	$161.061 - 7.204[\text{LC}] - 0.957[\text{BGC}] + 0.762[\text{LDM}] - 5.18 \times 10^{-5}[\text{N}]$	0.459	31.833	4	< 0.001
	Refu	$86.503 - 1.538[\text{BGC}] + 0.682[\text{LDM}] - 1.11 \times 10^{-5}[\text{N}]$	0.422	30.267	3	< 0.001
	Onle	$348.644 - 9.49 \times 10^{-5}[\text{N}] - 2.711[\text{FC}]$	0.503	29.681	2	< 0.001
	Orpa	$-5.388 + 0.851[\text{SRC}]$	0.168	4.459	1	0.035
	Sihi	$85.455 + 2.486[\text{SDC}] + 1.052[\text{OC}] + 0.247[\text{RPM}] - 3.16 \times 10^{-5}[\text{N}]$	0.480	54.795	4	< 0.001
	Mumu	$1658.979 - 0.001[\text{N}]$	0.587	26.898	1	< 0.001

Table 5. Interspecific interactions between species based on partial (below diagonal) and Spearman (above diagonal) correlations. Species abbreviations include: Spsp = *Spermophilus pilosoma*, Dico = *Dipodomys compactus*, Bata = *Baiomys taylori*, Refu = *Reithrodontomys fulvescens*, Onle = *Onychomys leucogaster*, Orpa = *Oryzomys palustris*, Sihi = *Sigmodon hispidus*, and Mumu = *Mus musculus*.

	Bata	Dico	Mumu	Onle	Orpa	Refu	Sihi	Spsp
Bata	--	-0.10	0.07	-0.08	0.13	0.260*	0.06	-0.06
Dico	-0.07	--	0.17*	0.22*	-0.1	-0.205*	0.00	0.07
Mumu	0.08	-0.10	--	0.51*	-0.03	0.06	0.37**	0.16
Onle	-0.13	0.14	0.20*	--	-0.04	-0.08	0.29**	-0.05
Orpa	-0.01	0.01	0.00	-0.01	--	-0.05	-0.08	-0.03
Refu	0.35**	-0.17	0.01	-0.06	-0.05	--	0.19*	-0.06
Sihi	-0.09	-0.13	0.12	0.01	-0.12	-0.21*	--	-0.03
Spsp	0.03	-0.13	0.29**	-0.01	0.02	0.04	0.04	--

* correlations statistically significant at $0.01 < P < 0.05$

** correlations statistically significant at $P < 0.01$

Table 6. Linear regression models predicting increased relative abundance based on species presence and habitat variables. Species abbreviations include: Spsp = *Spermophilus spilosoma*, Dico = *Dipodomys compactus*, Bata = *Baiomys taylori*, Refu = *Reithrodontomys fulvescens*, Onle = *Onychomys leucogaster*, Orpa = *Oryzomys palustris*, Sihi = *Sigmodon hispidus*, and Mumu = *Mus musculus*. Variable abbreviations include: CCH = closed canopy height, LDM = litter depth mean, N = nothing, OC = other cover, and RPV = Robel pole variance.

Species	Model Summary	r^2	F	df	P
Bata	$7.946 + 0.360[\text{Refu}] - 2.63 \times 10^{-6}[\text{N}] + 9.126^{-2}[\text{LDM}]$	0.161	8.695	139	< 0.001
Refu	$2.04 \times 10^2 + 0.167[\text{LDM}] + 0.296[\text{Bata}]$	0.186	15.674	139	< 0.001
Onle	$-0.222 + 0.715[\text{Mumu}] + 0.215 [\text{OC}] + 0.157[\text{Dico}]$	0.128	10.087	139	< 0.001
Mumu	$5.098 + 0.457[\text{Onle}] + 0.499[\text{Spsp}] + 2.44 \times 10^{-2}[\text{RPV}] - 3.51 \times 10^{-2}[\text{CCH}] - 1.77 \times 10^{-6}[\text{N}]$	0.401	17.947	139	< 0.001

Presence of other species did not contribute statistically to *Spsp*, *Dico*, *Orpa*, and *Sihi* relative abundance models

Table 7. Effectiveness of the discriminant functions in separating mammal clusters based on relative abundance of all 8 species.

<i>Function</i>	<i>Eigenvalue</i>	<i>Cumulative % of Variance Explained</i>	<i>Canonical Correlation</i>
1	22.52	65.78	0.98
2	10.38	96.11	0.96
3	1.05	99.19	0.72
4	0.28	100.00	0.47

Table 8. Species composition of mammal clusters derived from hierarchical cluster analysis. Species abbreviations include: Ssp = *Spermophilus spilosoma*, Dico = *Dipodomys compactus*, Bata = *Baiomys taylori*, Refu = *Reithrodontomys fulvescens*, Onle = *Onychomys leucogaster*, Orpa = *Oryzomys palustris*, Sihi = *Sigmodon hispidus*, and Mumu = *Mus musculus*.

Cluster	Bata	Dico	Mumu	Onle	Orpa	Refu	Sihi	Ssp
1	--	13.82%	37.50%	57.14%	--	--	5.38%	100.00%
2	--	34.21%	--	--	--	--	--	--
3	--	25.00%	12.50%	14.29%	--	--	6.45%	--
4	--	21.71%	--	7.14%	--	--	1.08%	--
5	--	--	--	--	75.00%	--	9.68%	--
6	78.95%	1.32%	--	--	25.00%	78.95%	5.38%	--
7	21.05%	3.95%	50.00%	21.43%	--	21.05%	44.09%	--
8	--	--	--	--	--	--	9.68%	--
9	--	--	--	--	--	--	18.28%	--
n	19	152	8	14	4	19	93	6

Table 9. Linear regression models explaining increased richness and alpha diversity. Original habitat variables and Northing (UTM Nad 83) were used. Variable abbreviations include: BGC = bare ground cover, GDPC = gulf dune paspalum cover, LDM = litter depth mean, and *N* = northing.

Metric	Model Summary	r^2	F	df	P
α_{richness}	$37.123 - 1.24 \times 10^{-5}[N] + 5.431 \times 10^{-2}[RPA] + 0.159[BGC] + 0.194[LDM] - 0.241[GDPC]$	0.39	17.11	139	< 0.001
α_H	$14.111 - 4.65 \times 10^{-6}[N] + 8.119 \times 10^{-2}[LDM]$	0.24	12.13	80	< 0.001

Table 10. Regression models predicting increased in richness and diversity.

Metric	Model Summary	r^2	F	df	P
α_{richness}	$0.761 + 3.239[\text{MumuPA}]$	0.43	98.548	80	4.02×10^{-19}
α_H	$0.211 + 0.964[\text{MumuPA}]$	0.42	56.265	80	4.96×10^{-11}

APPENDICES

APPENDIX I. MUSEUMS REPORTING SPECIMENS FROM MUSTANG, NORTH PADRE,
AND SOUTH PADRE ISLANDS. THE NUMBER OF SPECIMENS FROM EACH MUSEUM IS
INDICATED AS WELL AS THOSE MUSEUMS FROM WHICH NO RESPONSE WAS
MADE. ALL SPECIMENS WERE INCLUDED IN THE ANNOTATED LIST OF MAMMALS.

APPENDIX I. Museums reporting specimens from Mustang, North Padre, and South Padre islands. The number of specimens from each museum is indicated as well as those museums from which no response was made. All specimens were included in the annotated list of mammals.

Museum	Records	Notes
American Museum of Natural History (AMNH)	11	
Angelo State Natural History Collection (ASNHC)	168	
Burke Museum of Natural History and Culture, University of Washington (UWBM)	2	
Carnegie Museum of Natural History	0	
Centennial Museum, University of Texas El Paso	--	No Response
Louisiana State University Museum of Natural Science (LSUMZ)	26	
Museum of Natural History, Midwestern State University	0	
Museum of Southwestern Biology, University of New Mexico (MSB)	59	
Museum of Vertebrate Zoology, University of California, Berkley (MVZ)	12	
National Museum of Natural History (NMNH)	85	
Natural History Museum, University of Kansas (KU)	65	
Padre Island National Seashore Natural History Museum (PAISNHM)	18	
Pan American University, Mammal Collection	--	No Response
Royal Ontario Museum	0	
Slater Museum of Natural History, University of Puget Sound (PSM)	3	
Sternberg Museum of Natural History, Fort Hays State University	0	
Texas A&M Collections, Kingsville	--	No Response
Texas Cooperative Wildlife Collection, Texas A&M College Station (TCWC)	121	
The Field Museum	0	
The Msueum, Texas Tech University (TTU)	237	
University of Illinois Museum of Natural History (UIMNH)	145	
University of Michigan Museum of Zoology (UMMZ)	6	
Total	958	

APPENDIX II. LOCATIONS WHERE CAMERA TRAPS WERE SET. PRESENCE AND ABSENCE OF THE COYOTE, *CANIS LATRANS* (CALA), AND RACCOON, *PROCYON LOTOR* (PRLO), ARE INDICATED WITH A 1 OR 0 RESPECTIVELY. NO OTHER ANIMALS WERE DOCUMENTED

Date Set	Date Removed	Nights Set	Locality	Easting	Northing	Cala	Prlo
23-May-05	25-May-05	2	4.85 Mi North 8.92 Mi East, El Martillo	667744	3033245	1	0
23-May-05	25-May-05	2	4.90 Mi North, 8.97 Mi East, El Martillo	667779	3033317	1	0
26-May-05	28-May-05	2	0.19 Mi South, 7.23 Mi East, El Martillo	665142	3024943	1	0
26-May-05	28-May-05	2	0.105 Mi North, 7.21 Mi East, El Martillo	665096	3024953	1	0
28-May-05	30-May-05	2	4.66 Mi South, 6.06 Mi East, El Martillo	663231	3017864	0	0
28-May-05	30-May-05	2	4.55 Mi South, 5.70 Mi East, El Martillo	663371	3017803	1	0
6-Jun-05	7-Jun-05	1	25.0 Mi South, 31.6 Mi East, Armstrong	671536	2939566	0	1
7-Jun-05	8-Jun-05	1	24.7 Mi South, 31.5 Mi East, Armstrong	671406	2939535	1	0
6-Jun-05	8-Jun-05	2	24.8 Mi South 31.1 Mi East Armstrong	670719	2939326	1	1
8-Jun-05	10-Jun-05	2	19.9 Mi South, 30.3 Mi East, Armstrong	668979	2946905	0	0
8-Jun-05	10-Jun-05	2	20.2 Mi South, 30.2 Mi East, Armstrong	669048	2946904	0	0
10-Jun-05	12-Jun-05	2	15.5 Mi South, 29.9 Mi East, Armstrong	666777	2954558	0	0
10-Jun-05	12-Jun-05	2	15.0 Mi South, 28.7 Mi East, Armstrong	666465	2954474	0	0
11-Jul-05	12-Jul-05	1	8.25 Mi East, 5.81 Mi North, El Martillo	666885	3034317	1	1
11-Jul-05	12-Jul-05	1	8.25 Mi East, 5.81 Mi North, El Martillo	666885	3034317	0	0
30-May-06	1-Jun-06	2	6.22 Mi North, 7.28 Mi East, El Martillo	665057	3035241	0	0
30-May-06	1-Jun-06	2	6.06 Mi North, 7.50 Mi East, El Martillo	665402	3034984	0	0
4-Jun-06	6-Jun-06	2	8.56 Mi North, 10.4 Mi East, El Martillo	669996	3039219	0	0
4-Jun-06	6-Jun-06	2	8.74 Mi North, 10.3 Mi East, El Martillo	669791	3039362	0	0
6-Jun-06	8-Jun-06	2	16.0 Mi North, 3.65 Mi East, Port Mansfield	662426	2963896	0	0
6-Jun-06	8-Jun-06	2	16.0 Mi North, 3.50 Mi East, Port Mansfield	662105	2963802	0	0
8-Jun-06	10-Jun-06	2	15.70 Mi North, 3.10 Mi East, Port Mansfield	661511	2963501	0	0
8-Jun-06	10-Jun-06	2	15.90 Mi North, 2.80 MI East, Port Mansfield	661019	2963600	0	0
10-Jun-06	12-Jun-06	2	25.70 Mi North, 1.81 Mi East, Port Mansfield	659554	2979451	1	0

10-Jun-06	12-Jun-06	2	25.80 MI North, 1.70 Mi East, Port Mansfield	659531	2979303	0	0
26-Jun-06	28-Jun-06	2	8.05 Mi North, 6.25 Mi East, Port Mansfield	666731	2951281	0	0
26-Jun-06	28-Jun-06	2	8.28 Mi North, 6.39 Mi East, Port Mansfield	666931	2951565	0	0
28-Jun-06	30-Jun-06	2	0.651 Mi North, 7.24 Mi East, Port Mansfield	668389	2939555	0	0
28-Jun-06	30-Jun-06	2	0.70 Mi North, 7.28 Mi East, Port Mansfield	668592	2939311	0	0
30-Jun-06	2-Jul-06	2	0.840 Mi North, 6.80 Mi East, Port Mansfield	667838	2939571	0	0
30-Jun-06	2-Jul-06	2	0.70 Mi North, 6.84 Mi East, Port Mansfield	667890	2939533	0	0
11-Jul-06	13-Jul-06	2	34.08 Mi North, 2.88 Mi East, Port Mansfield	660664	2994175	0	0
11-Jul-06	13-Jul-06	2	34.08 Mi North, 3.01 Mi East, Port Mansfield	660740	2994167	0	0
13-Jul-06	15-Jul-06	2	3.95 Miles East, 9.76 Miles South, El Martillo	659926	3009361	0	0
13-Jul-06	15-Jul-06	2	34.30 Mi North, 2.71 Mi East, Port Mansfield	659984	3009329	0	0
18-Aug-06	18-Aug-06	3	5.87 Miles East, 1.04 Miles North, El Martillo	662989	3026617	0	0

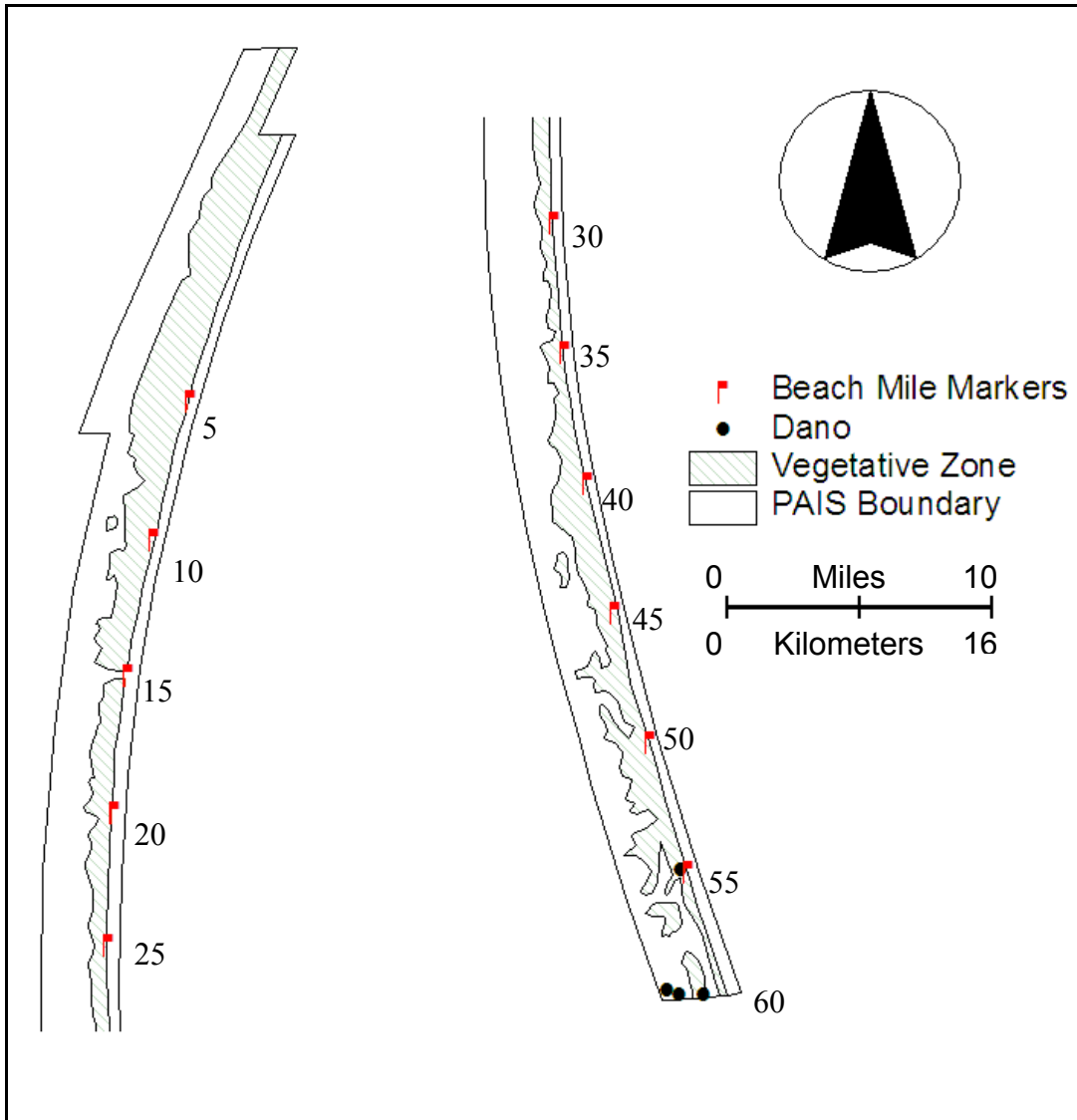
APPENDIX III. CHECKLIST OF THE MAMMALS OF PADRE ISLAND NATIONAL
SEASHORE. LITERATURE REFERENCES, MUSEUM SPECIMENS, AND CAPTURE AND
OBSERVATIONAL LOCALITIES OF ALL SPECIES ARE INCLUDED IN THE ANNOTATED
LIST OF MAMMALS

<i>Scientific Name</i>	<i>Common Name</i>	<i>Park Status</i>	<i>Nativity</i>
<i>Didelphis virginiana</i>	Virginia opossum	probably present	native
<i>Dasypus novemcinctus</i>	nine-banded armadillo	present	native
<i>Sciurus niger</i>	eastern fox squirrel	encroaching	native
<i>Spermophilus mexicanus</i>	Mexican ground squirrel	false report	native
<i>Spermophilus spilosoma</i>	spotted ground squirrel	present	native
<i>Geomys personatus</i>	Texas pocket gopher	present	native
<i>Dipodomys compactus</i>	Gulf Coast kangaroo rat	present	native
<i>Perognathus merriami</i>	Merriam's pocket mouse	historical	native
<i>Chaetodipus hispidus</i>	hispid pocket mouse	historical	native
<i>Liomys irroratus</i>	Mexican spiny pocket mouse	encroaching	native
<i>Ondatra zibethicus</i>	muskrat	encroaching	native
<i>Baiomys taylori</i>	northern pygmy mouse	present	native
<i>Reithrodontomys fulvescens</i>	fulvous harvest mouse	present	native
<i>Neotoma micropus</i>	southern plains woodrat	false report	native
<i>Onychomys leucogaster</i>	northern grasshopper mouse	present	native
<i>Peromyscus leucopus</i>	white-footed mouse	encroaching	native
<i>Peromyscus maniculatus</i>	deer mouse	encroaching	native
<i>Oryzomys couesi</i>	Coues' rice rat	encroaching	Native
<i>Oryzomys palustris</i>	marsh rice rat	present	Native
<i>Sigmodon hispidus</i>	hispid cotton rat	present	Native
<i>Mus musculus</i>	house mouse	present	non-native
<i>Rattus norvegicus</i>	Norway rat	unconfirmed	non-native
<i>Rattus rattus</i>	roof rat	present	non-native
<i>Myocastor coypus</i>	nutria	encroaching	non-native
<i>Lepus californicus</i>	Black-tailed jackrabbit	present	native
<i>Sylvilagus floridanus</i>	eastern cottontail	unconfirmed	native
<i>Cryptotis parva</i>	least shrew	encroaching	native
<i>Notiosorex crawfordi</i>	desert shrew	encroaching	native

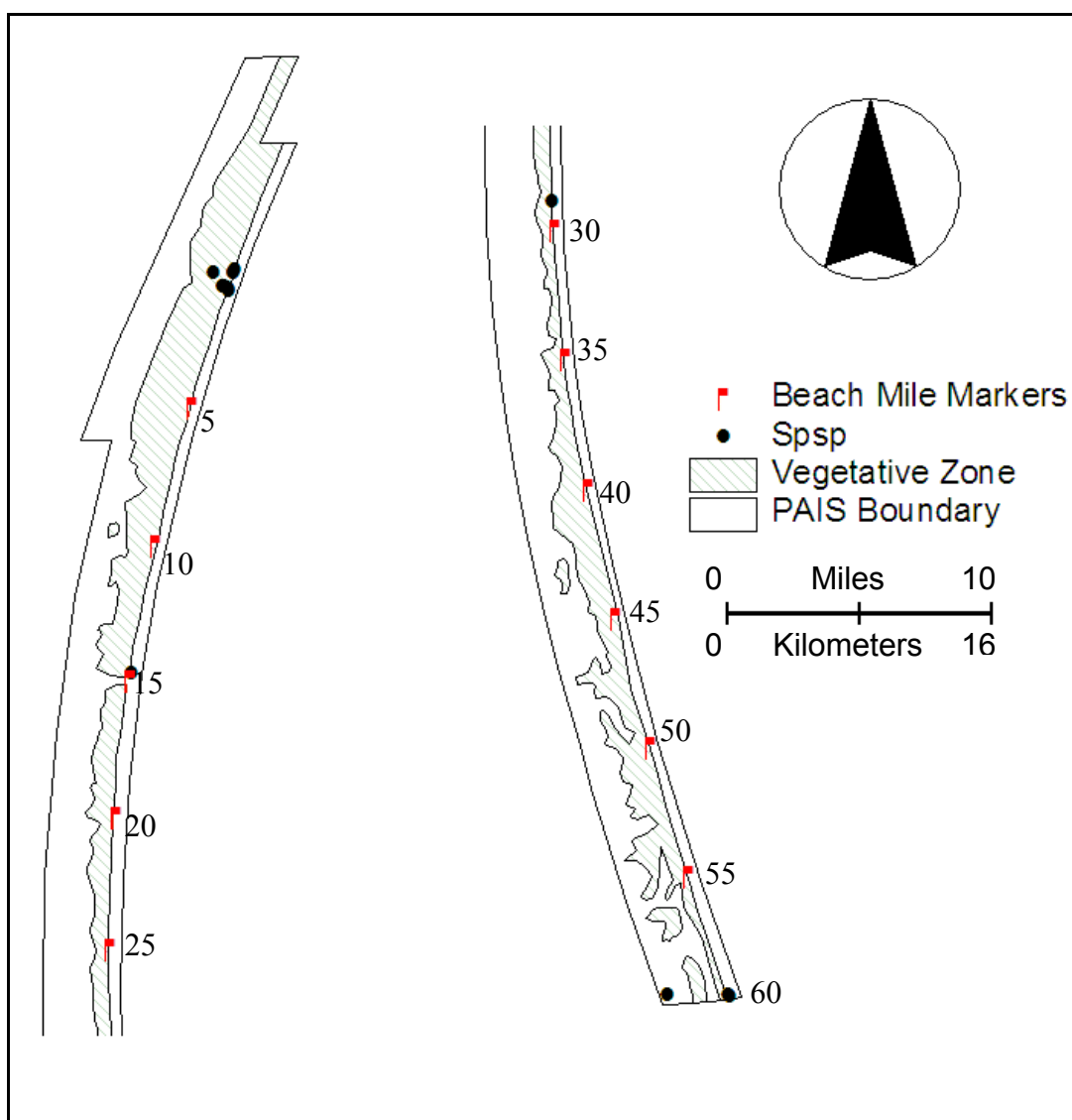
<i>Scalopus aquaticus</i>	eastern mole	present	native
<i>Tadarida brasiliensis</i>	Brazilian free-tailed bat	present	native
<i>Eptesicus fuscus</i>	big brown bat	encroaching	native
<i>Nycticeius humeralis</i>	evening bat	encroaching	native
<i>Lasiurus borealis</i>	red bat	encroaching	Native
<i>Lasiurus cinereus</i>	hoary bat	encroaching	Native
<i>Lasiurus intermedius</i>	northern yellow bat	unconfirmed	Native
<i>Lasiurus seminolus</i>	seminole bat	encroaching	Native
<i>Pipistrellus subflavus</i>	eastern pipistrelle	probably present	Native
<i>Myotis velifer</i>	cave bat	encroaching	Native
<i>Felis catus</i>	House cat	encroaching	non-native
<i>Leopardus pardalis</i>	ocelot	unconfirmed	native
<i>Lynx rufus</i>	bobcat	probably present	Native
<i>Puma concolor</i>	cougar	unconfirmed	Native
<i>Puma yagouaroundi</i>	jaguarundi	unconfirmed	Native
<i>Panthera onca</i>	jaguar	unconfirmed	Native
<i>Urocyon cinereoargenteus</i>	common gray fox	present	Native
<i>Canis latrans</i>	coyote	present	Native
<i>Canis lupus familiaris</i>	domestic dog	encroaching	non-native
<i>Canis lupus familiaris x latrans</i>	domestic dog/coyote hybrid	historical	non-native
<i>Canis rufus</i>	red wolf	historical	Native
<i>Mustela frenata</i>	long-tailed weasel	encroaching	Native
<i>Taxidea taxus</i>	American badger	present	Native
<i>Conepatus leuconotus</i>	North American hog-nosed skunk	unconfirmed	Native
<i>Mephitis mephitis</i>	striped skunk	present	Native
<i>Spilogale putorius</i>	eastern spotted skunk	unconfirmed	Native
<i>Nasua narica</i>	white-nosed coati	probably present	Native
<i>Procyon lotor</i>	northern raccoon	present	Native
<i>Equus caballus</i>	horse	historical	non-native

<i>Sus scrofa</i>	feral pig	encroaching	non-native
<i>Pecari tajacu</i>	collared peccary	probably present	Native
<i>Bos Taurus</i>	cow	historical	non-native
<i>Boselaphus tragocamelus</i>	nilgai	present	non-native
<i>Odocoileus virginianus</i>	white-tailed deer	present	native

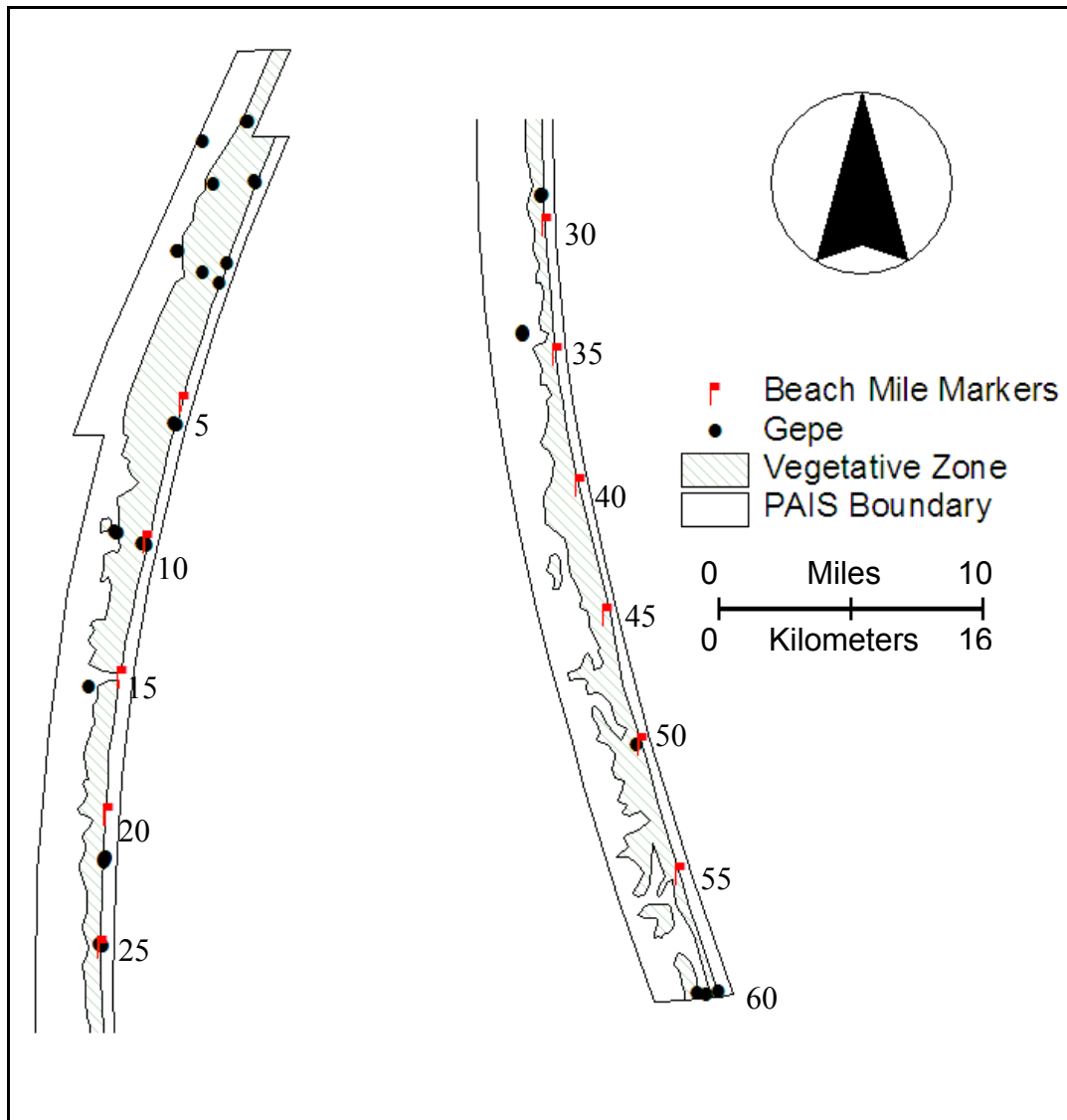
APPENDIX IV. LOCATIONS WHERE *DASYPUS NOVEMCINCTUS* (DANO) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN PARK BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



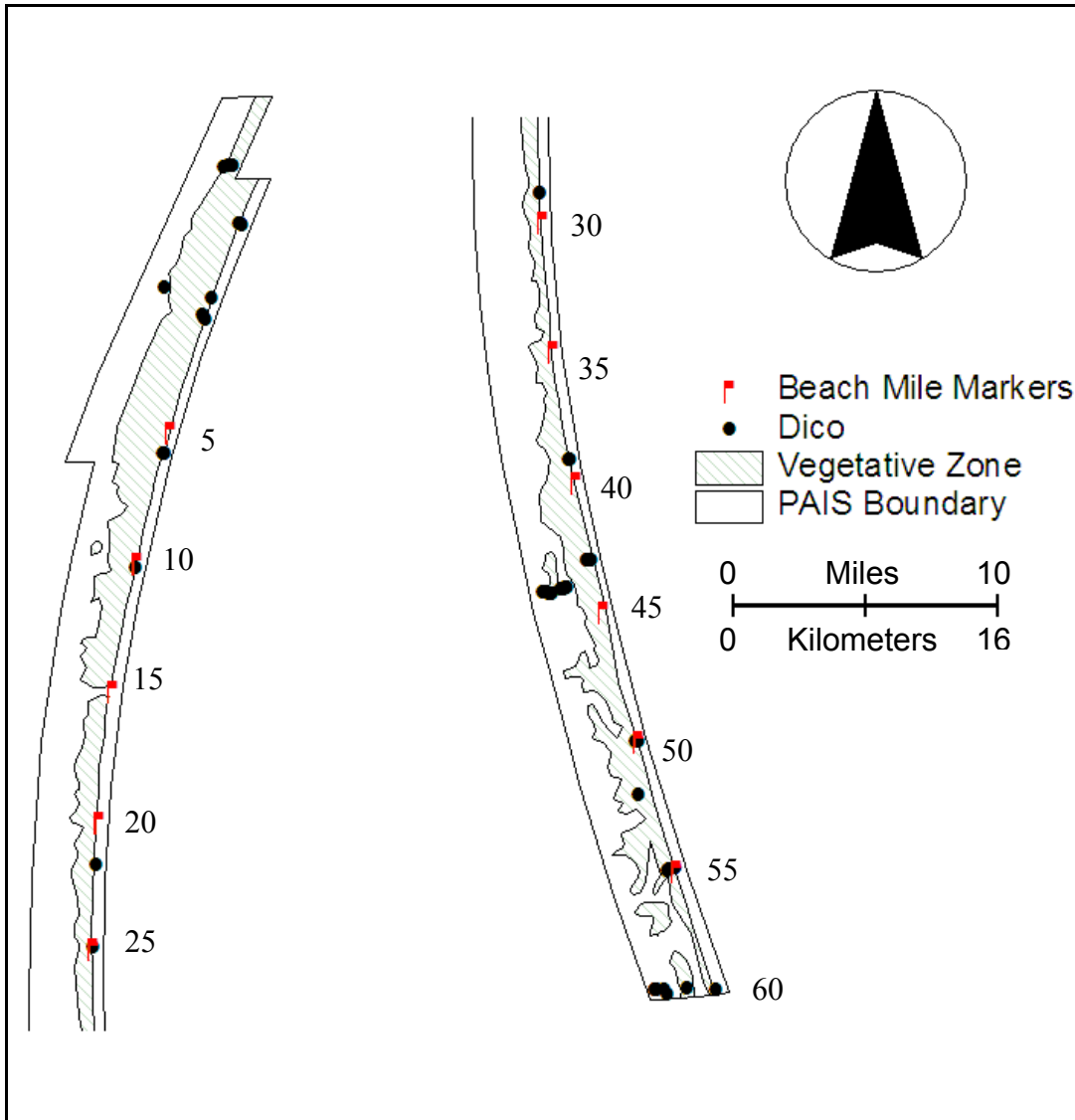
APPENDIX V. LOCATIONS WHERE *SPERMOPHILUS SPILOSOMA* (SPSP) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



APPENDIX VI. LOCATIONS WHERE *GEOMYS PERSONATUS* (GEPE) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



APPENDIX VII. LOCATIONS WHERE *DIPODOMYS COMPACTUS* (DICO) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



APPENDIX VIII. LOCATIONS WHERE *BAIOMYS TAYLORI* (BATA) WAS DOCUMENTED

WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY.

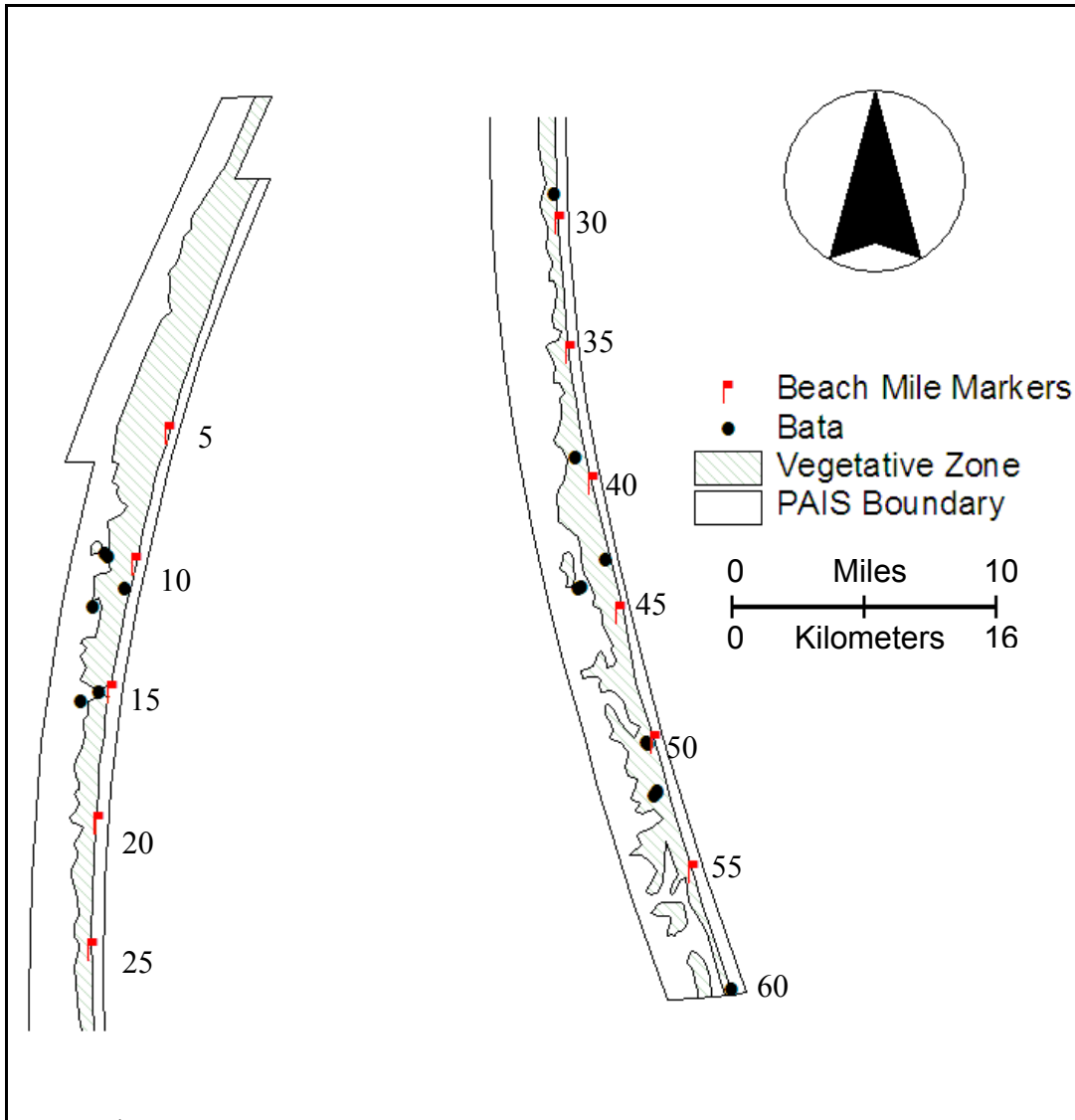
THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES

FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY

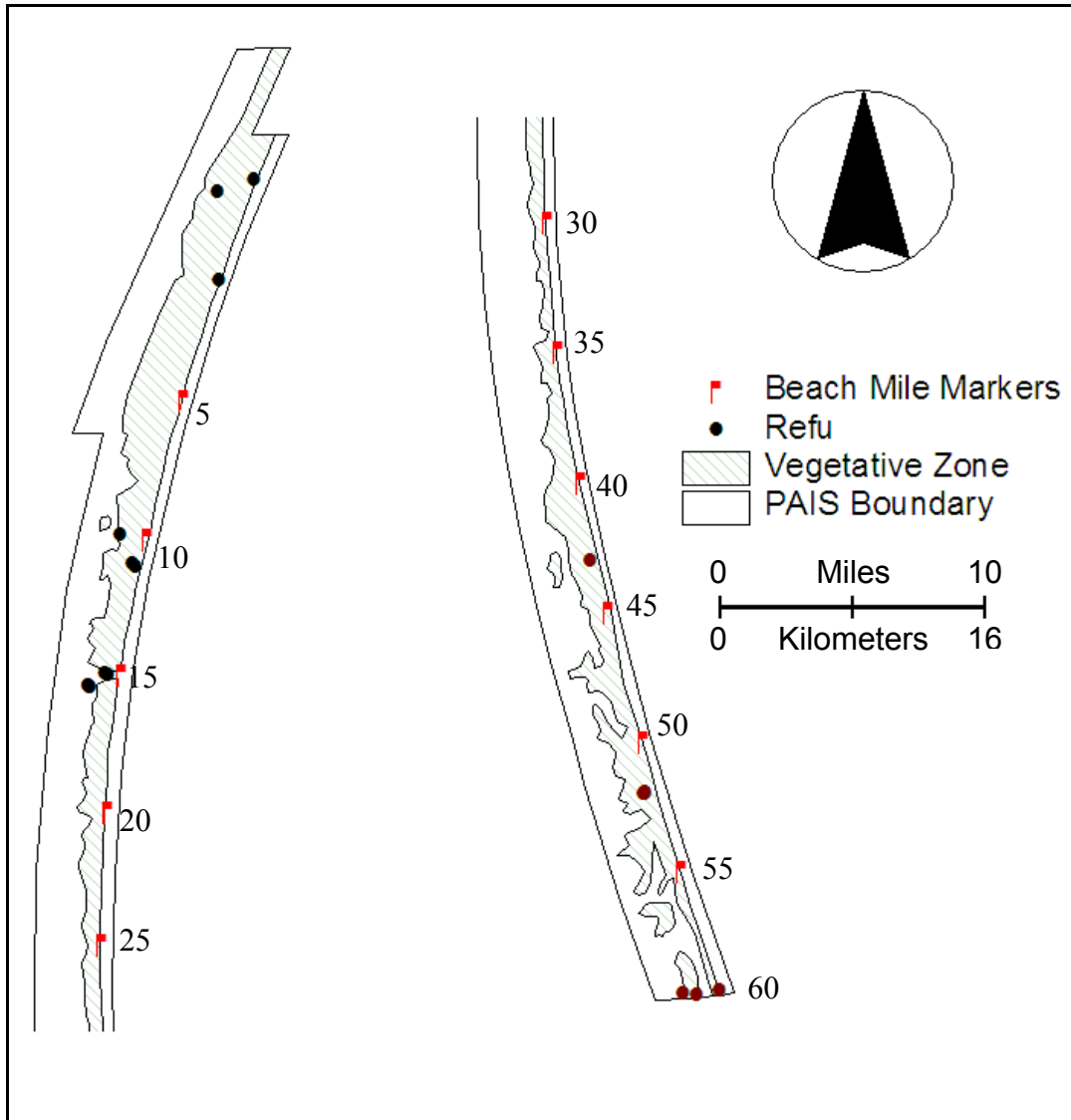
BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS

TRAPPING LOCALITIES FROM APPROXIMATELY BEACH

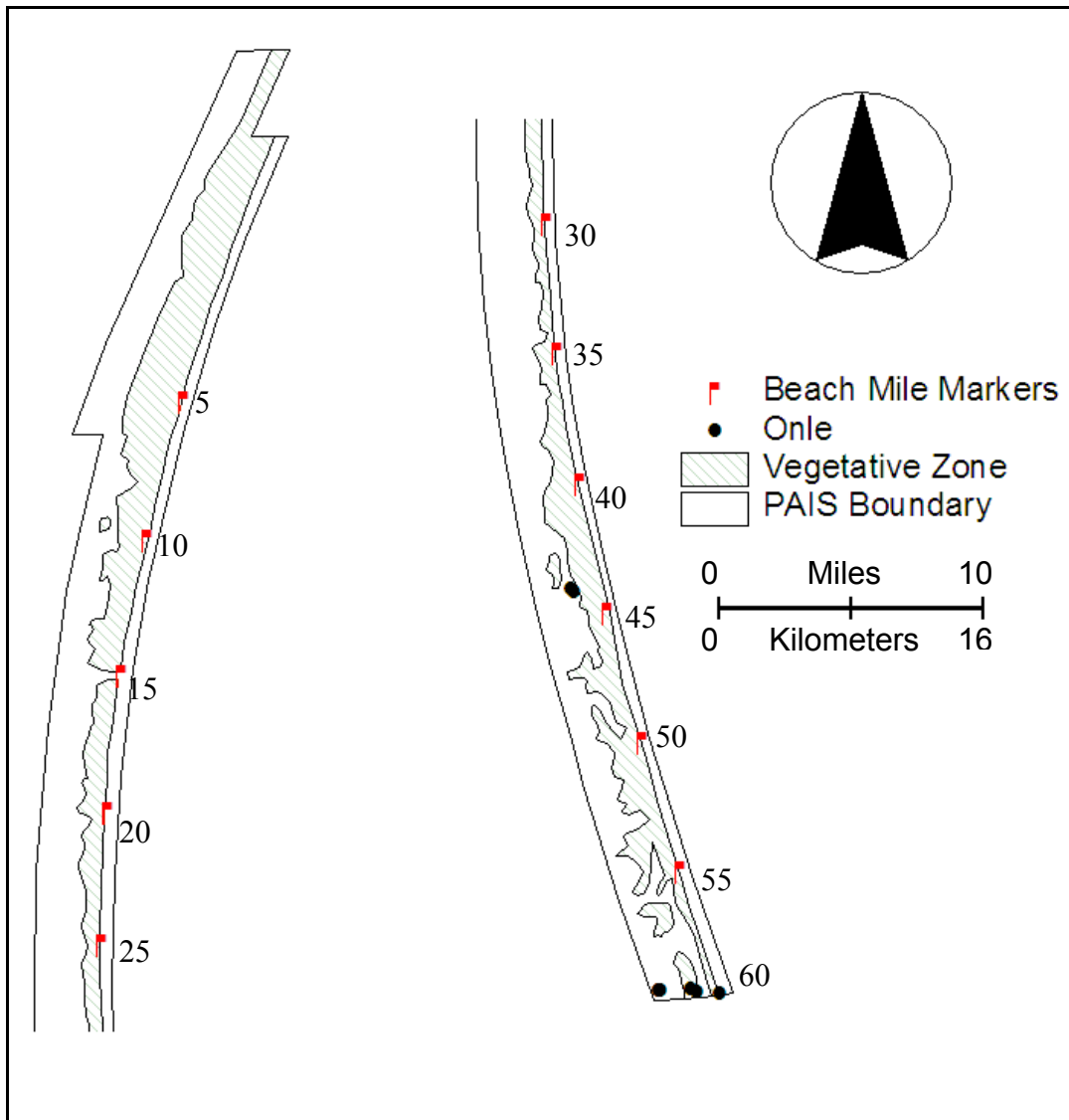
MILE 28.5 TO MANSFIELD CHANNEL.



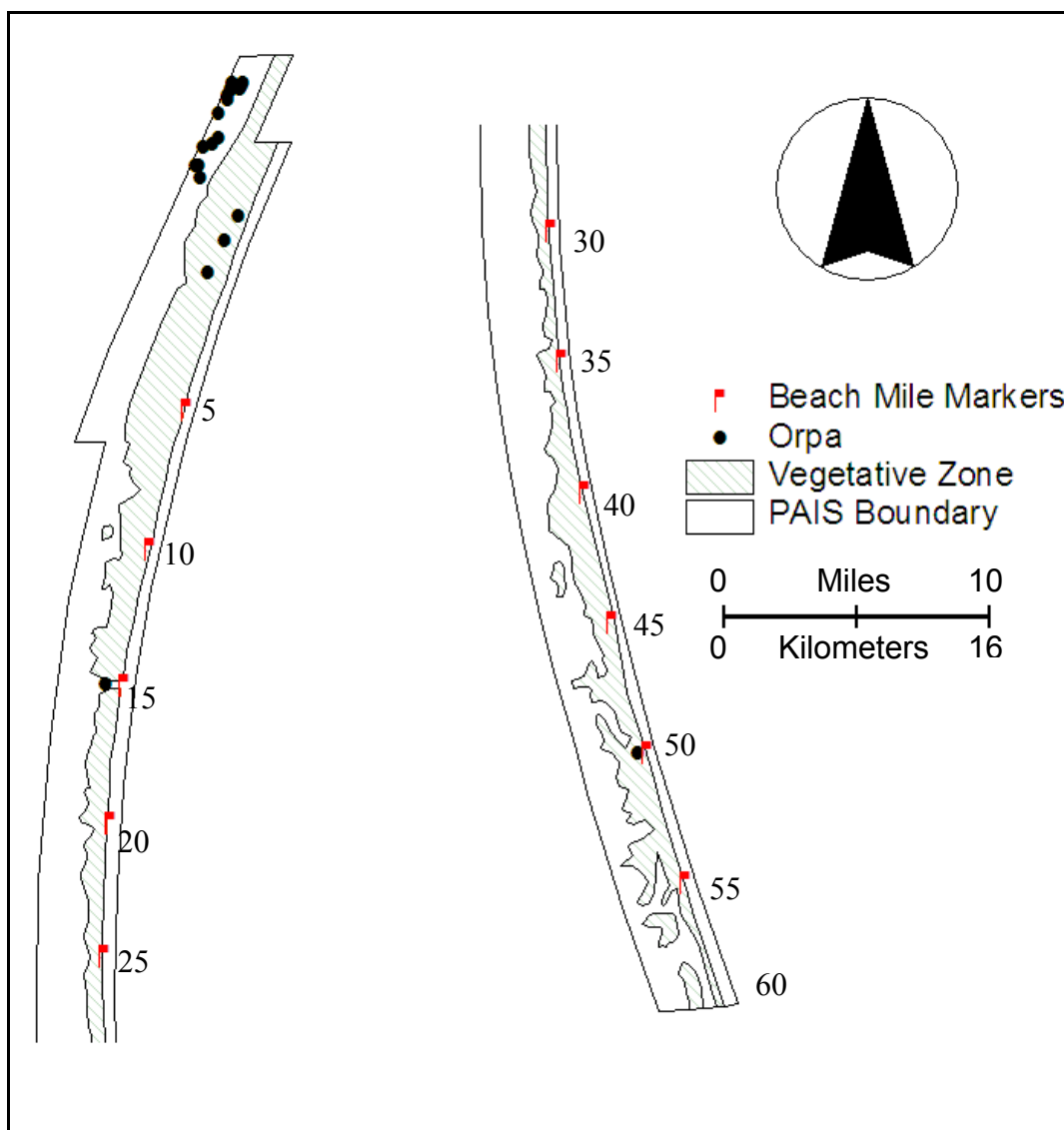
APPENDIX IX. LOCATIONS WHERE *REITHRODONTOMYS FULVESCENS* (REFU) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



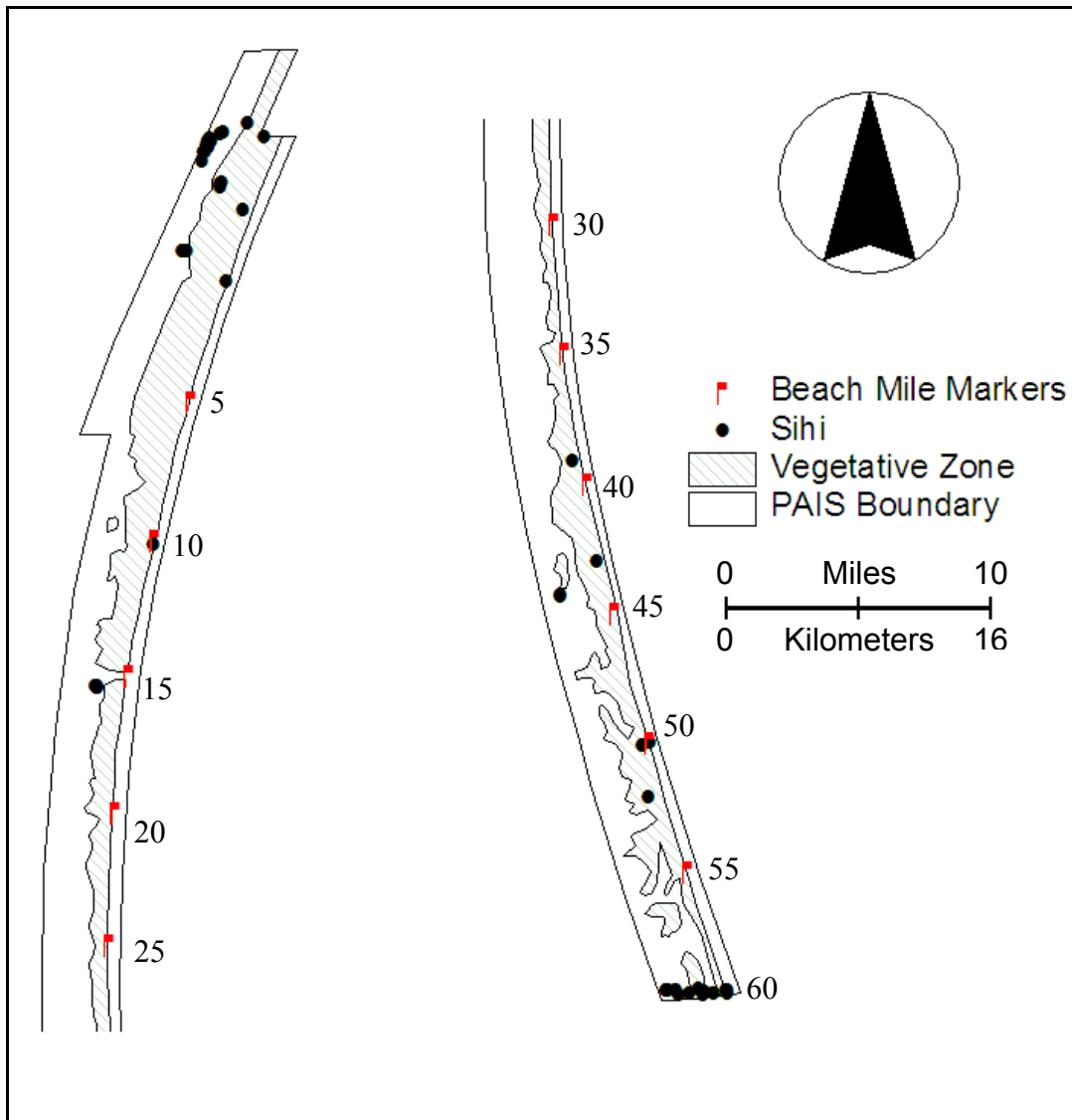
APPENDIX X. LOCATIONS WHERE *ONYCHOMYS LEUCOGASTER* (ONLE) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



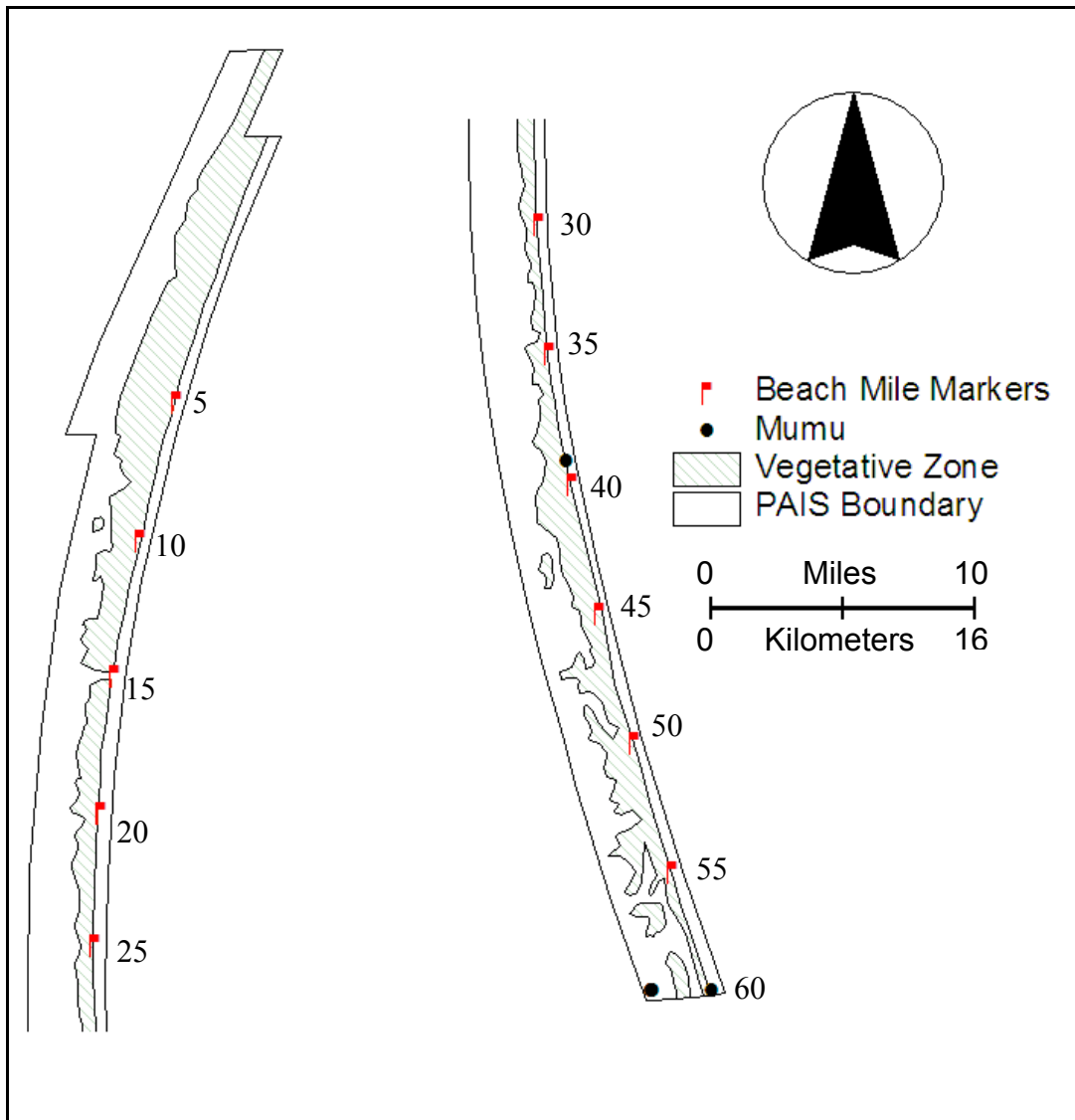
APPENDIX XI. LOCATIONS WHERE *ORYZOMYS PALUSTRIS* (ORPA) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



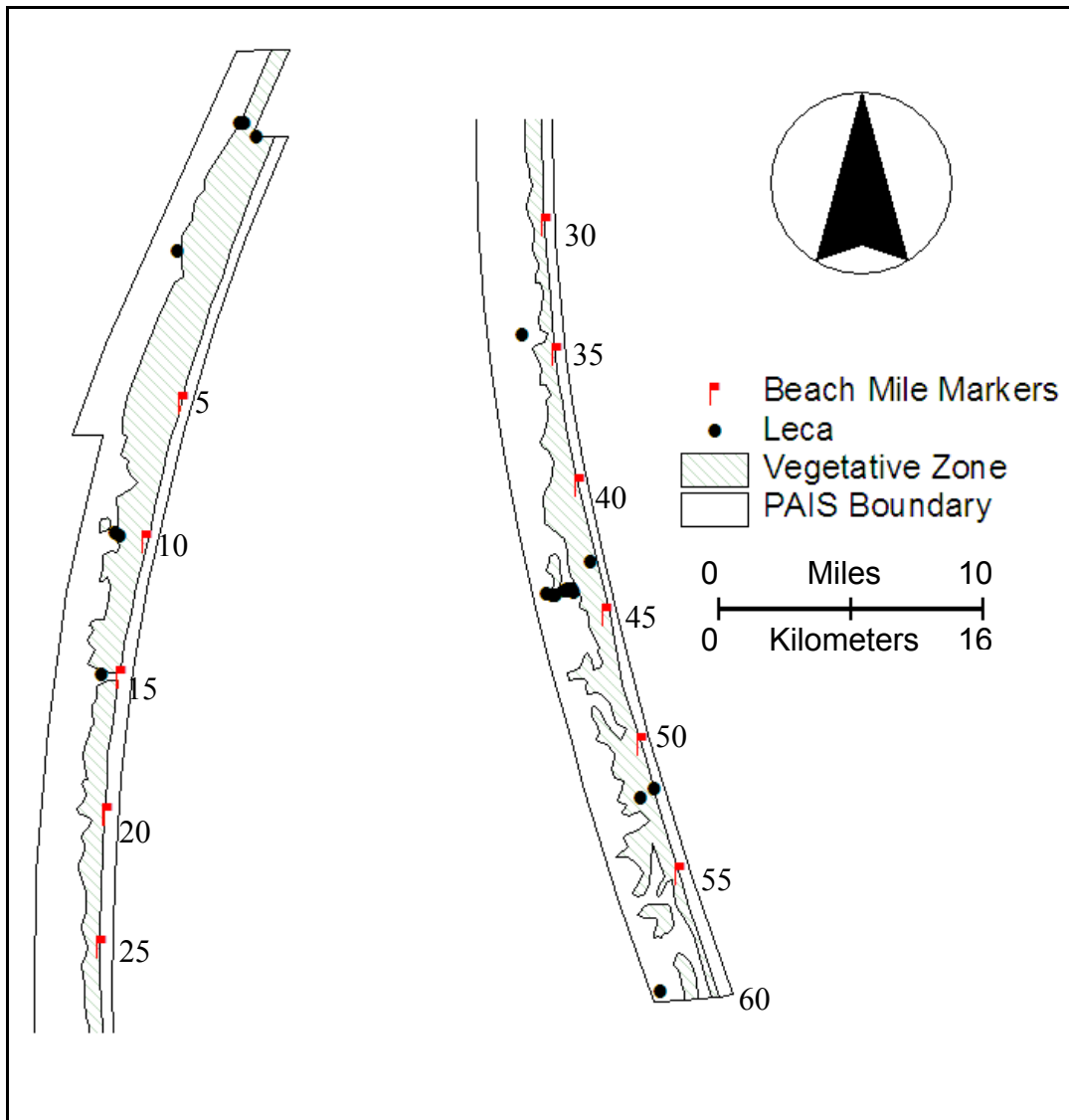
APPENDIX XII. LOCATIONS WHERE *SIGMODON HISPIDUS* (SIHI) WAS DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH
MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS
TRAPPING LOCALITIES FROM APPROXIMATELY
BEACH MILE 28.5 TO MANSFIELD CHANNEL.



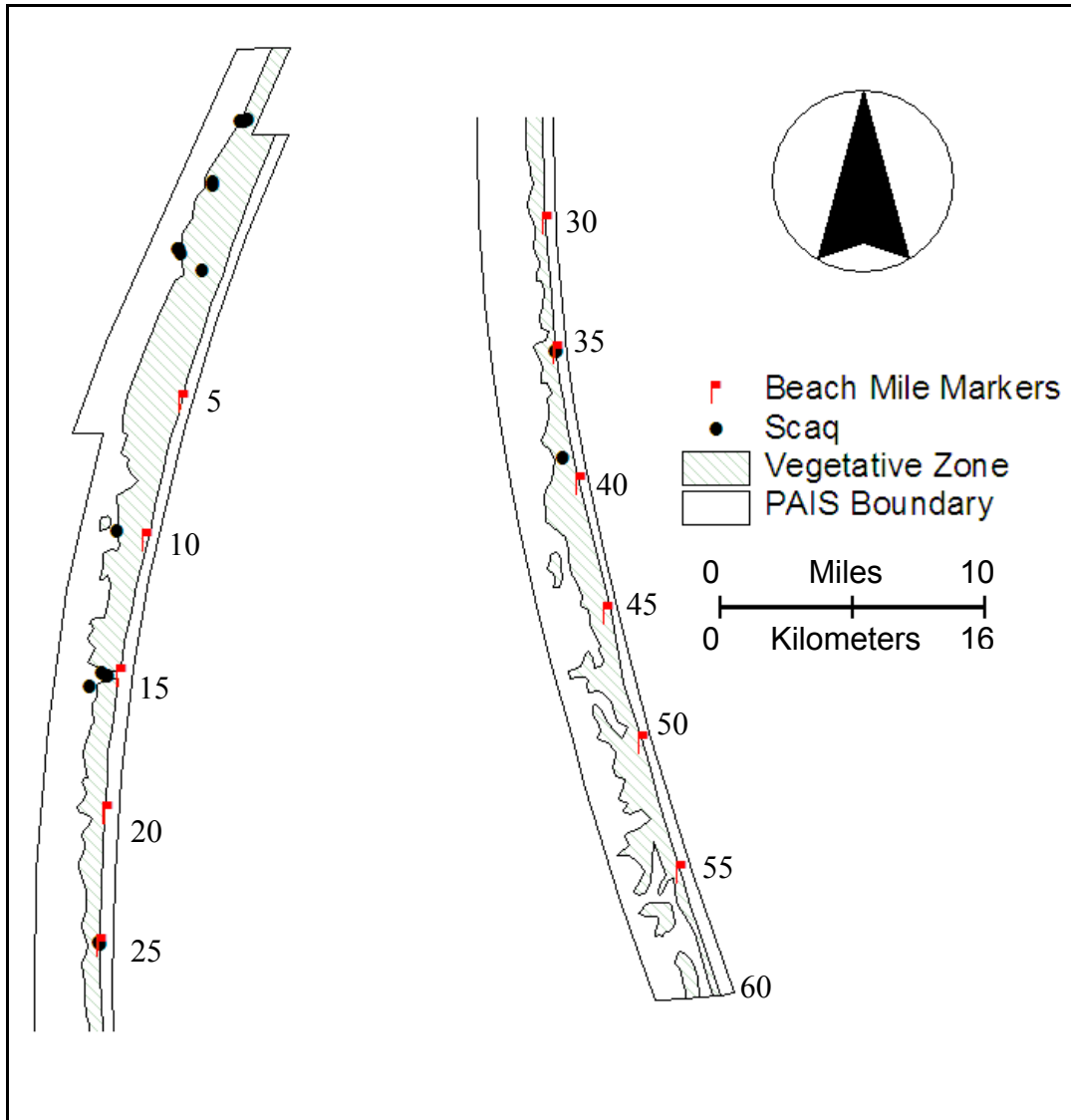
APPENDIX XIII. LOCATIONS WHERE *MUS MUSCULUS* (MUMU) WAS DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH
MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS
TRAPPING LOCALITIES FROM APPROXIMATELY
BEACH MILE 28.5 TO MANSFIELD CHANNEL.



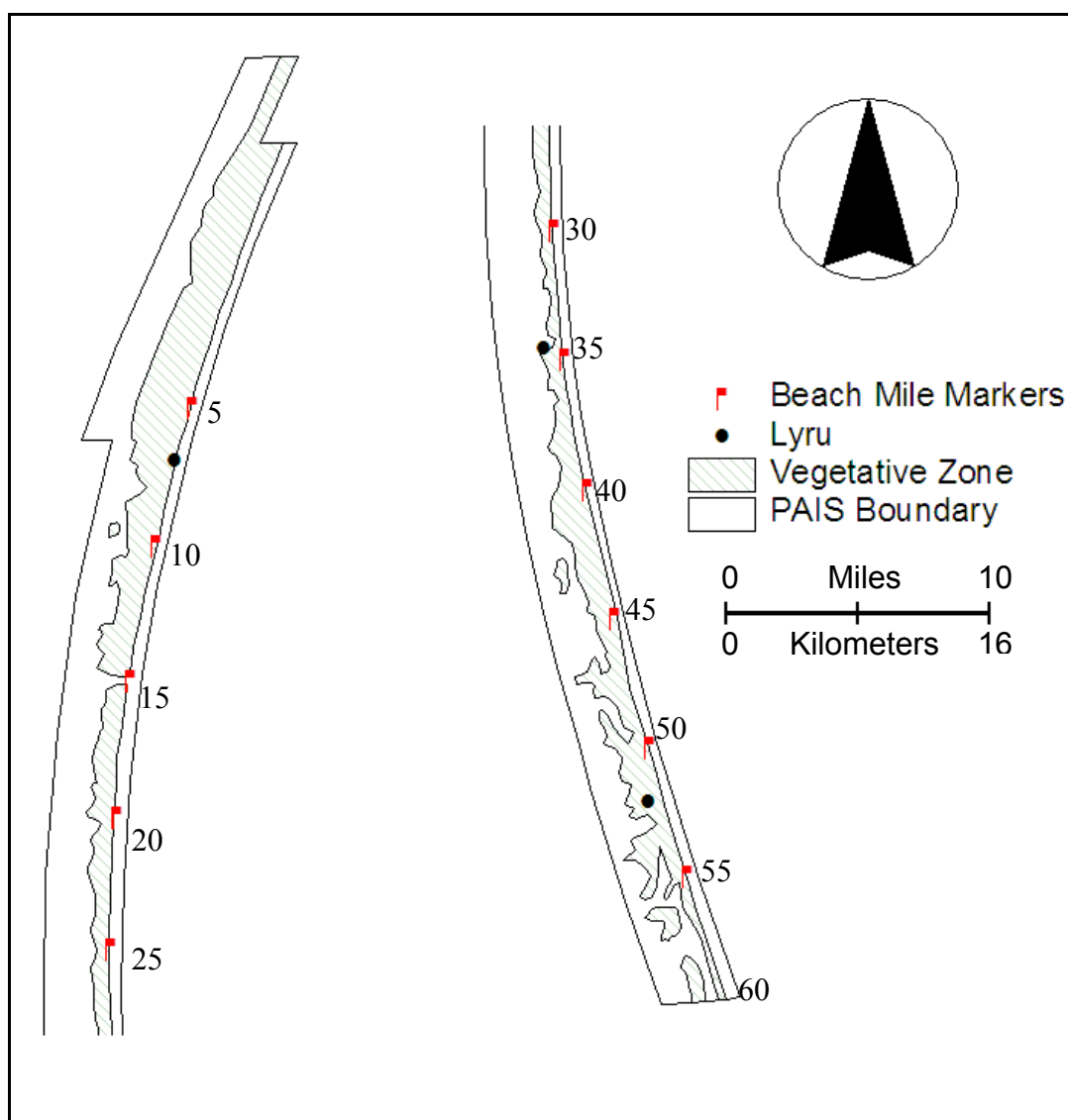
APPENDIX XIV. LOCATIONS WHERE LEPUS CALIFORNICUS (LECA) WAS
DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING
THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING
LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO
APPROXIMATELY BEACH MILE 28.5. THE SECTION ON
THE RIGHT REPRESENTS TRAPPING LOCALITIES
FROM APPROXIMATELY BEACH MILE 28.5
TO MANSFIELD CHANNEL.



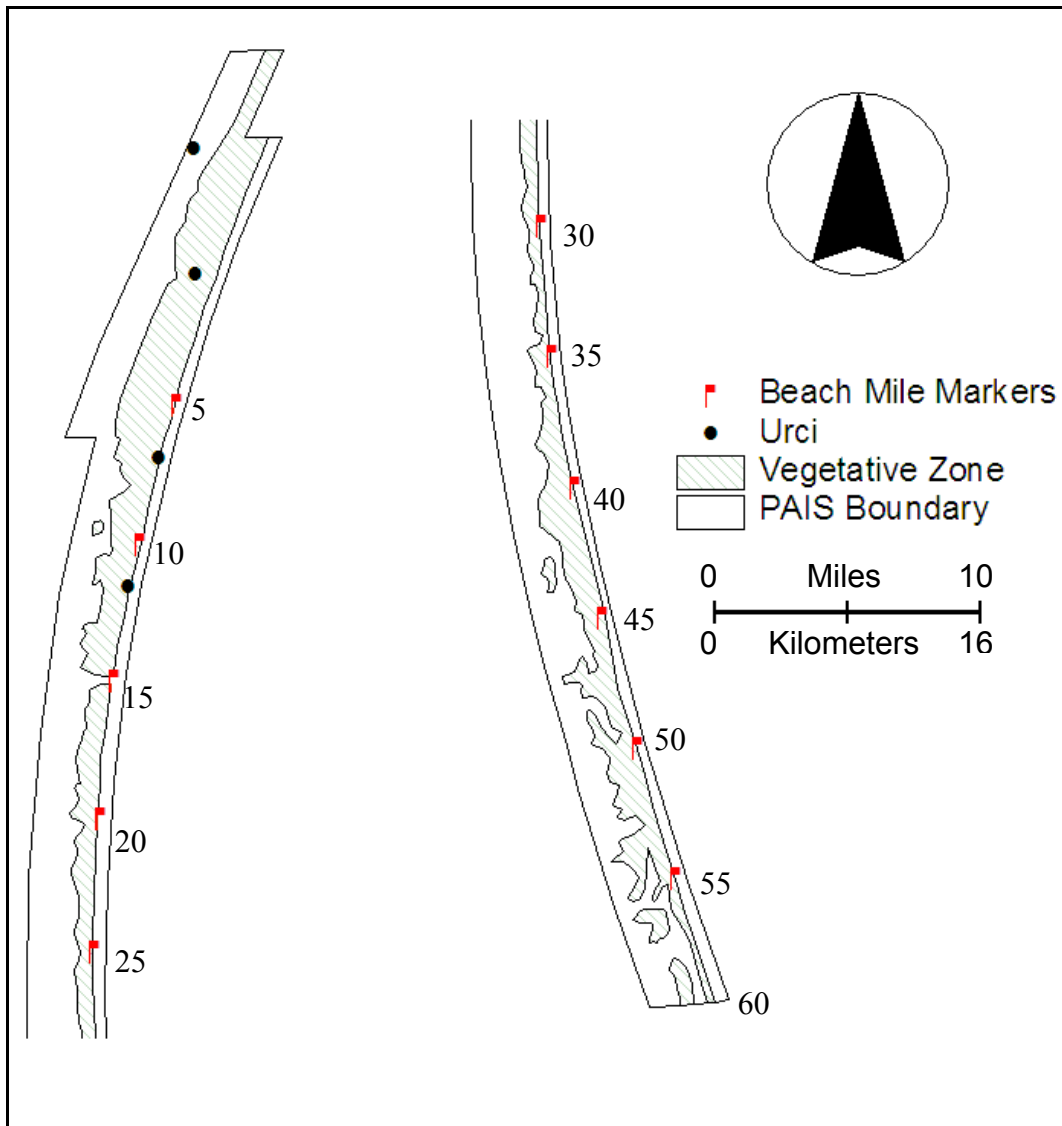
APPENDIX XV. LOCATIONS WHERE *SCALOPUS AQUATICUS* (SCAQ) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



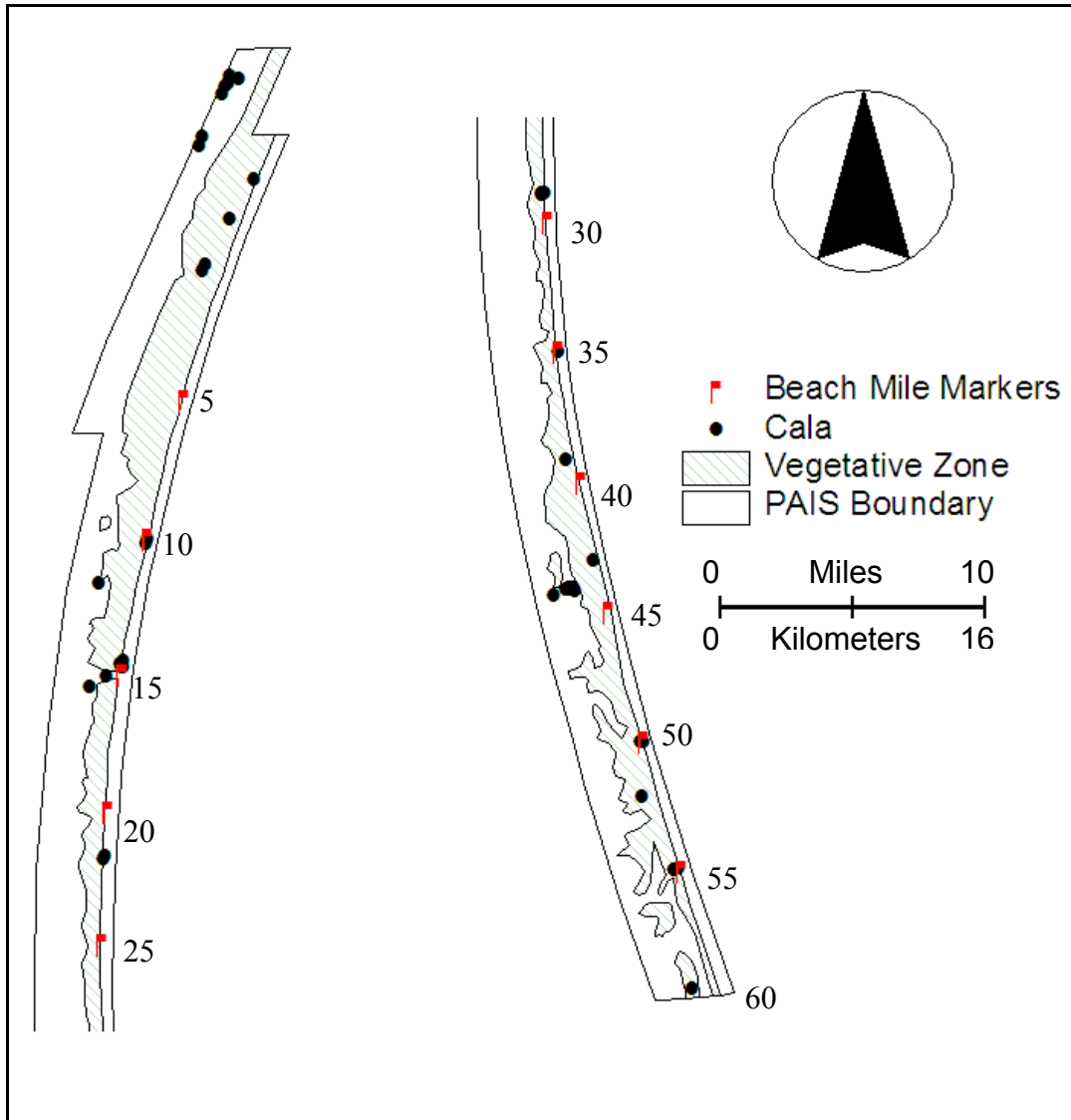
APPENDIX XVI. LOCATIONS WHERE *LYNX RUFUS* (LYRU) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



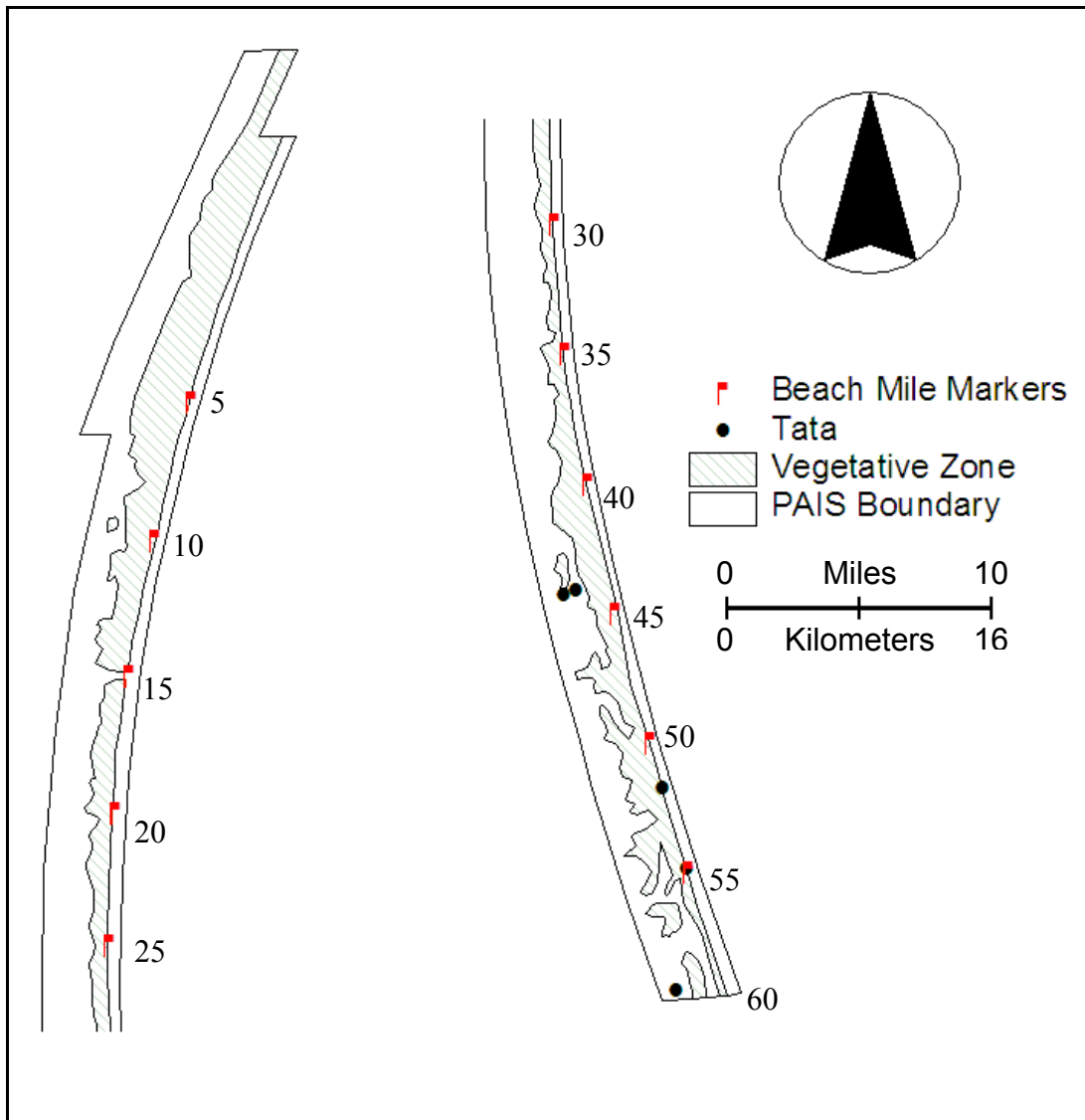
APPENDIX XVII. LOCATIONS WHERE *UROCYON CINEREOARGENTEUS* (URCI) WAS DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS TRAPPING LOCALITIES FROM APPROXIMATELY BEACH MILE 28.5 TO MANSFIELD CHANNEL.



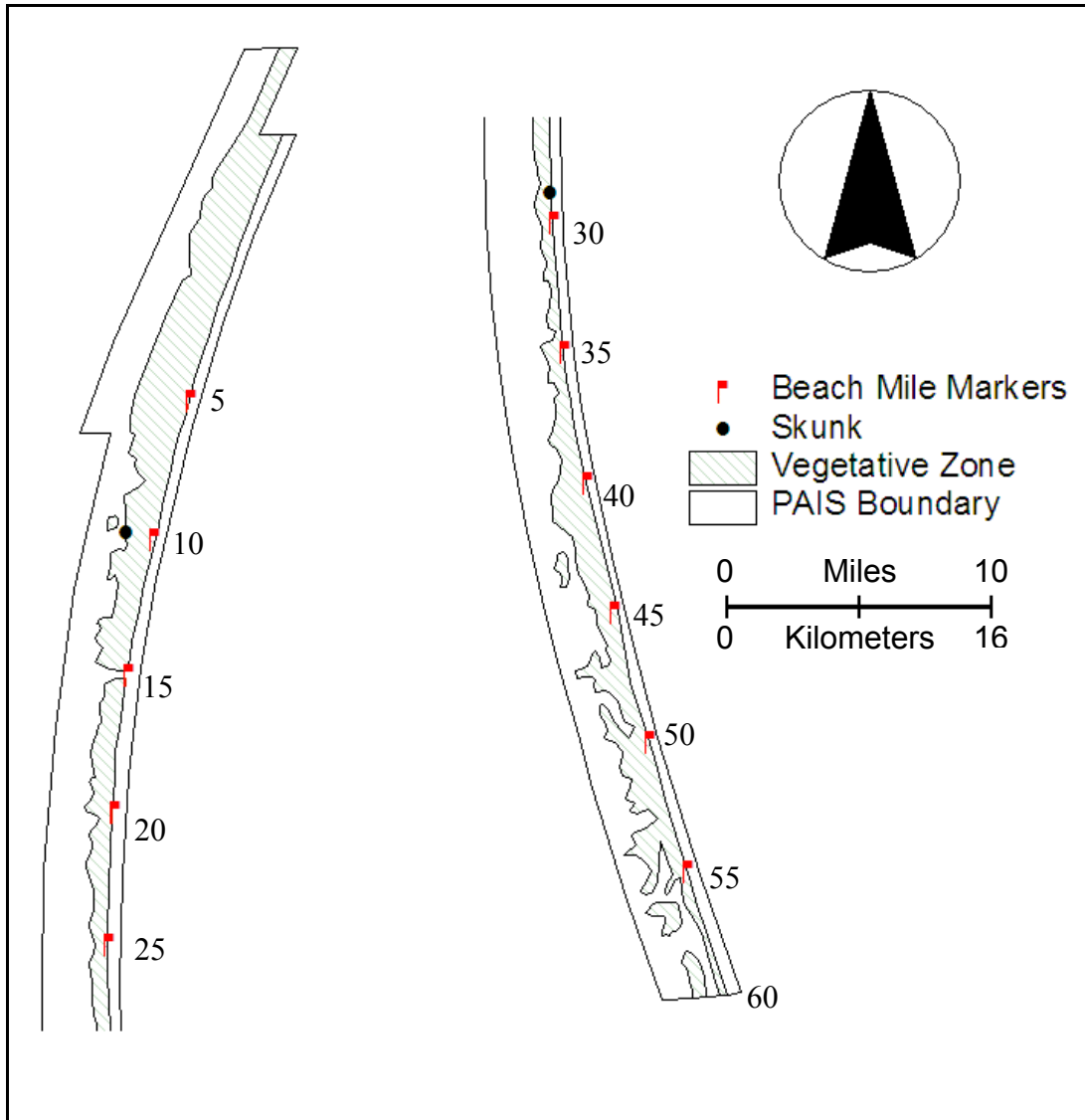
APPENDIX XVIII. LOCATIONS WHERE *CANIS LATRANS* (CALA) WAS DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY
BEACH MILE 28.5. THE SECTION ON THE RIGHT
REPRESENTS TRAPPING LOCALITIES FROM
APPROXIMATELY BEACH MILE 28.5
TO MANSFIELD CHANNEL.



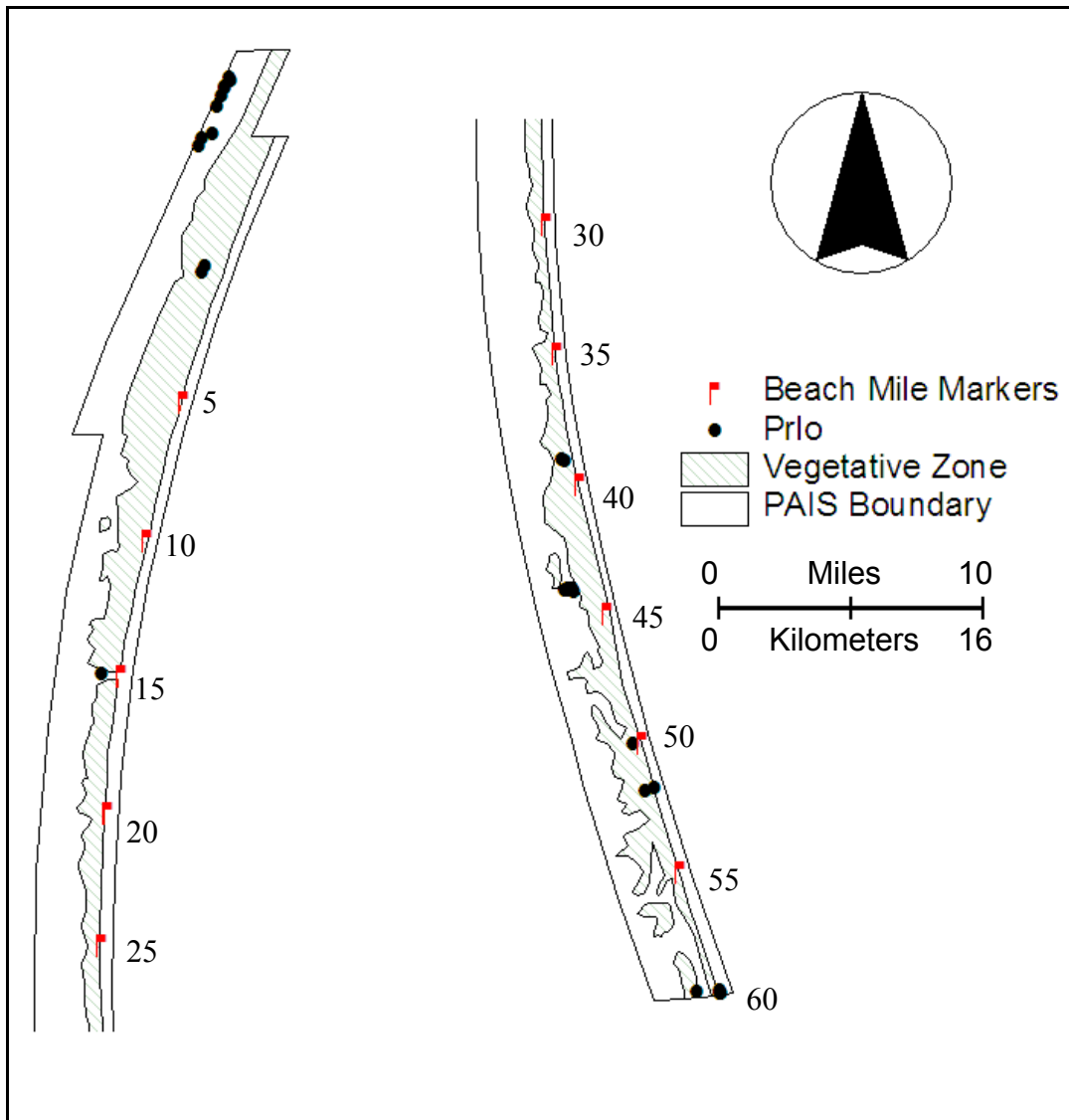
APPENDIX XIX. LOCATIONS WHERE *TAXIDEA TAXUS* (TATA) WAS DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY
BEACH MILE 28.5. THE SECTION ON THE RIGHT
REPRESENTS TRAPPING LOCALITIES FROM
APPROXIMATELY BEACH MILE 28.5 TO
MANSFIELD CHANNEL.



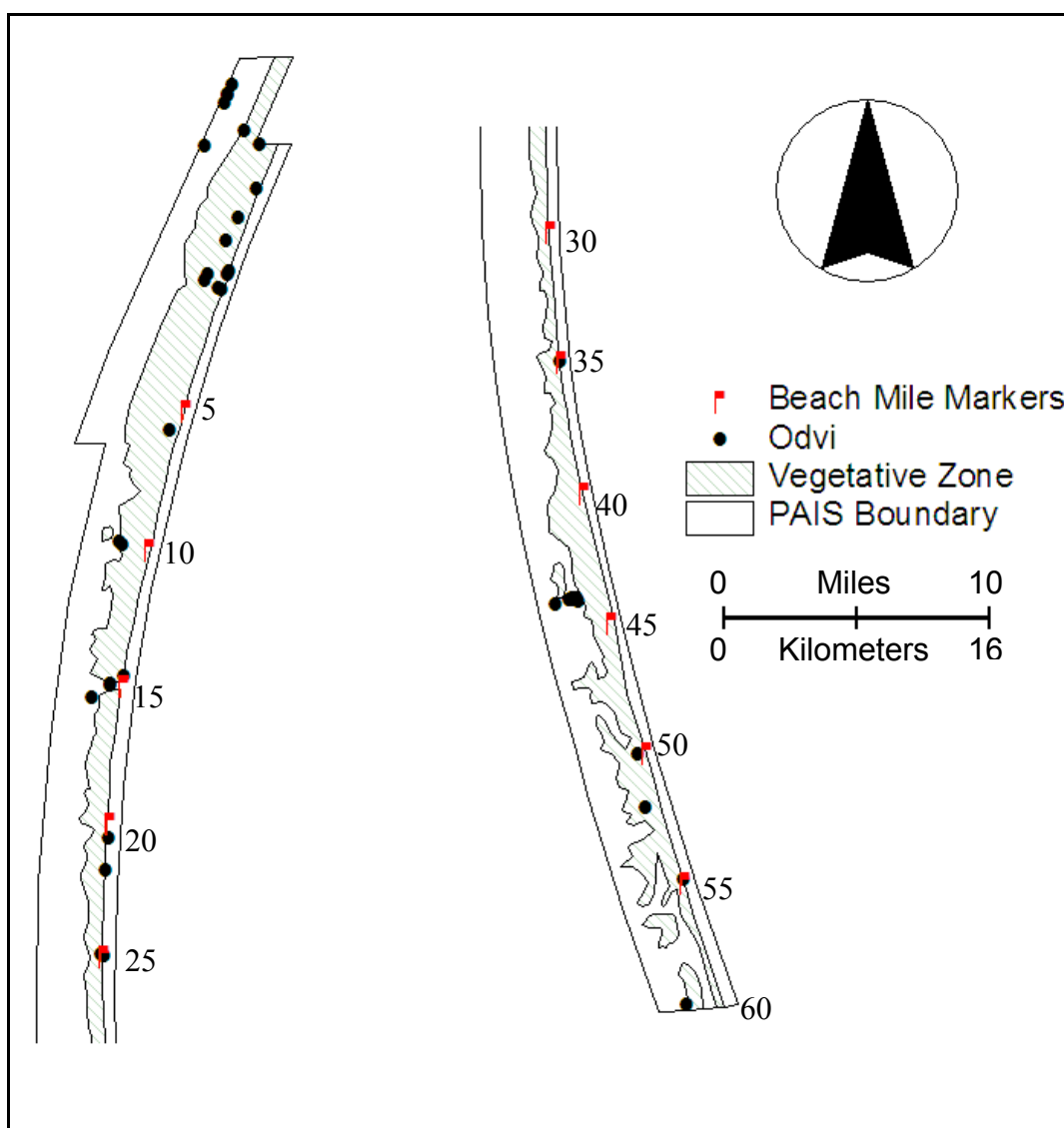
APPENDIX XX. LOCATIONS WHERE UNIDENTIFIED SKUNKS WERE DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY BEACH
MILE 28.5. THE SECTION ON THE RIGHT REPRESENTS
TRAPPING LOCALITIES FROM APPROXIMATELY
BEACH MILE 28.5 TO MANSFIELD
CHANNEL.



APPENDIX XXI. LOCATIONS WHERE *PROCYON LOTOR* (PRLO) WAS DOCUMENTED
WITHIN PADRE ISLAND NATIONAL SEASHORE DURING THIS STUDY. THE
SECTION ON THE LEFT REPRESENTS TRAPPING LOCALITIES FROM
THE NORTHERN BOUNDARY SOUTH TO APPROXIMATELY
BEACH MILE 28.5. THE SECTION ON THE RIGHT
REPRESENTS TRAPPING LOCALITIES FROM
APPROXIMATELY BEACH MILE 28.5 TO
MANSFIELD CHANNEL.



APPENDIX XXII. LOCATIONS WHERE *ODOCOILEUS VIRGINIANUS* (ODVI) WAS
DOCUMENTED WITHIN PADRE ISLAND NATIONAL SEASHORE DURING
THIS STUDY. THE SECTION ON THE LEFT REPRESENTS TRAPPING
LOCALITIES FROM THE NORTHERN BOUNDARY SOUTH TO
APPROXIMATELY BEACH MILE 28.5. THE SECTION ON
THE RIGHT REPRESENTS TRAPPING LOCALITIES
FROM APPROXIMATELY BEACH MILE
28.5 TO MANSFIELD CHANNEL.



APPENDIX XXIII. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TESTS
BETWEEN TRANSECTS WHERE *SPERMOPHILUS SPILOSOMA* WAS
PRESENT AND ABSENT. MEANS (STANDARD ERROR) THAT
WERE STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

	<i>Spermophilus spilosoma</i>		Z	P
	Absent (n = 135)	Present (n = 5)		
Grass cover	2.823 (0.092)	2.445 (0.383)	-0.606	0.544
Forb cover	1.51 (0.038)	1.69 (0.229)	-0.872	0.383
Gulf dune paspalum cover	1.51 (0.059)	1.335 (0.335)	-1.218	0.223
Sedge & rush cover	1.341 (0.073)	1 (0)	-1.753	0.080
Standing dead cover	1.132 (0.019)	1.34 (0.177)	-1.506	0.132
Litter cover	1.158 (0.02)	1.42 (0.15)	-2.403	0.016
Standing water cover	1.066 (0.023)	1 (0)	-1.001	0.317
Bare ground cover	2.489 (0.112)	3.035 (0.745)	-0.960	0.337
Other cover	1.139 (0.041)	1.055 (0.055)	-0.952	0.341
Canopy height mean	3.628 (0.284)	3.135 (1.069)	-0.017	0.987
Canopy height variance	16.38 (3.816)	10.109 (3.172)	-0.174	0.862
Litter depth mean	0.558 (0.088)	0.303 (0.132)	-0.396	0.692
Litter depth variance	1.623 (0.384)	0.318 (0.227)	-0.368	0.713
RP mean	13.776 (0.582)	10.54 (2.773)	-0.848	0.397
RP variance	46.049 (3.873)	69.124 (21.676)	-1.409	0.159
Soil moisture mean	1.701 (0.075)	1 (0)	-2.059	0.039
Soil moisture variance	0.159 (0.029)	0 (0)	-1.269	0.204

APPENDIX XXIV. GENERAL HABITAT DESCRIPTION OF *SPERMOPHILUS SPILOSOMA*.

RELATIVE ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED ONTO

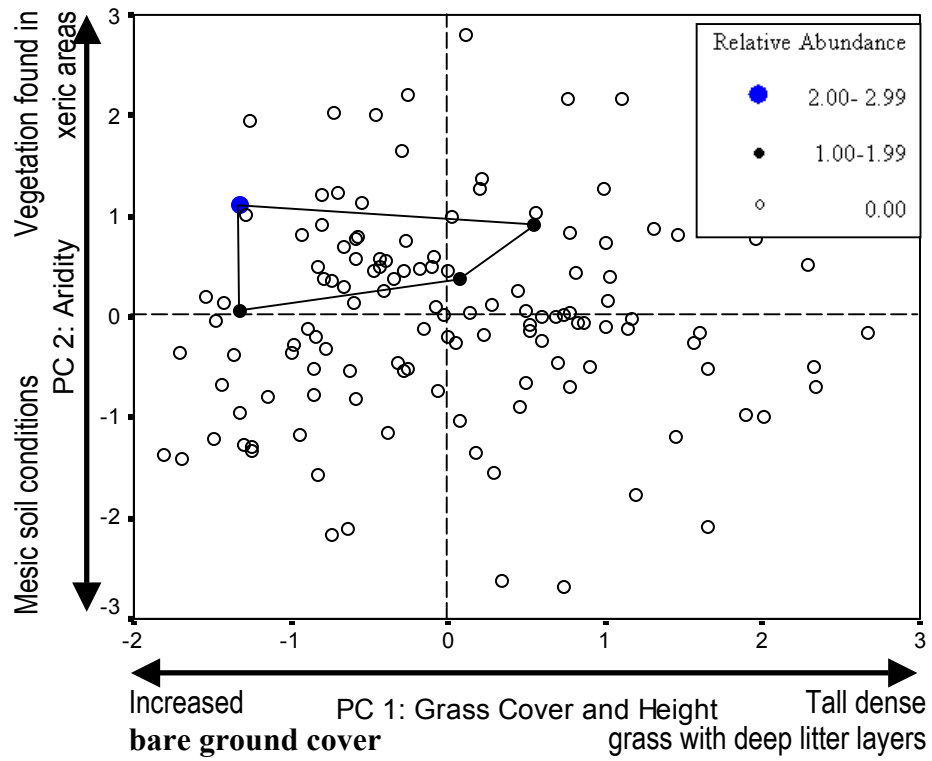
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT

GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS

WHERE THIS SPECIES WAS CAPTURED WERE

SURROUNDED BY MINIMUM CONVEX

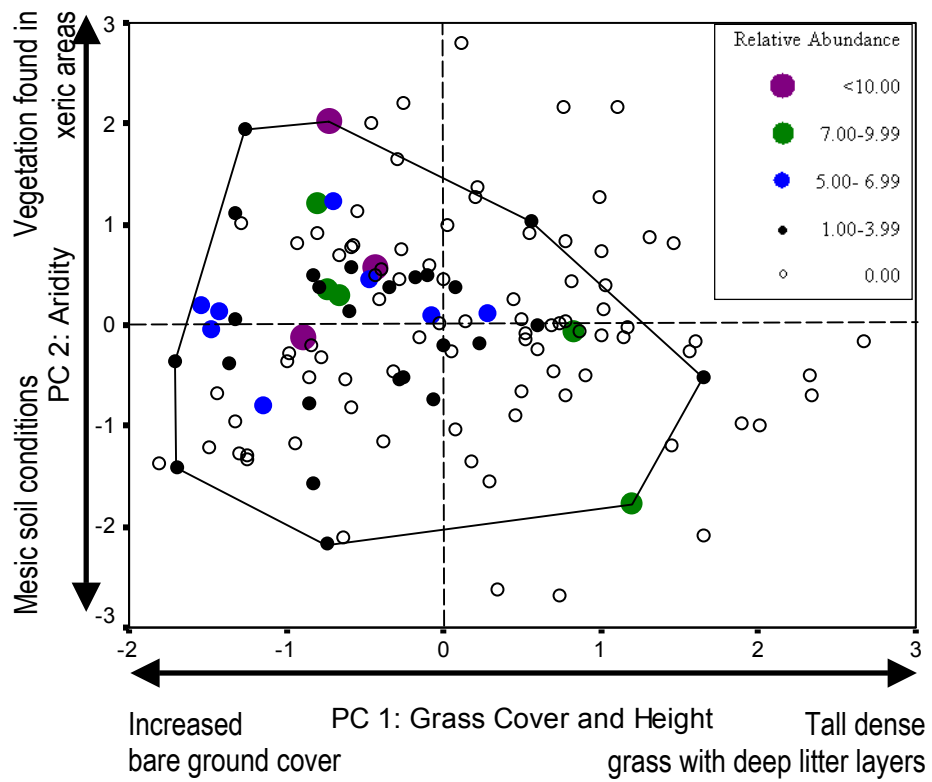
POLYGONS.



APPENDIX XXV. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TESTS
BETWEEN TRANSECTS WHERE *DIPODOMYS COMPACTUS* WAS
PRESENT AND ABSENT. MEANS (STANDARD ERROR) THAT
WERE STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

	<i>Dipodomys compactus</i>			
	<i>Absent (n = 98)</i>	<i>Present (n = 42)</i>	<i>Z</i>	<i>P</i>
Grass cover	2.958 (0.113)	2.463 (0.131)	-2.476	0.013
Forb cover	1.526 (0.046)	1.496 (0.063)	-0.114	0.909
Gulf dune paspalum cover	1.667 (0.074)	1.123 (0.045)	-5.082	<0.001
Sedge & rush cover	1.425 (0.092)	1.104 (0.087)	-2.910	0.004
Standing dead cover	1.131 (0.023)	1.159 (0.033)	-1.625	0.104
Litter cover	1.159 (0.025)	1.186 (0.032)	-1.740	0.082
Standing water cover	1.083 (0.031)	1.016 (0.01)	-0.652	0.514
Bare ground cover	2.054 (0.115)	3.57 (0.165)	-6.373	<0.001
Other cover	1.155 (0.055)	1.092 (0.026)	-0.373	0.709
Canopy height mean	4.246 (0.357)	2.127 (0.291)	-3.053	0.002
Canopy height variance	17.627 (4.942)	12.724 (4.239)	-1.231	0.218
Litter depth mean	0.639 (0.118)	0.337 (0.058)	-0.405	0.685
Litter depth variance	1.928 (0.523)	0.755 (0.146)	-0.330	0.742
RP mean	14.704 (0.687)	11.227 (0.933)	-2.892	0.004
RP variance	41.603 (4.372)	59.17 (7.33)	-2.415	0.016
Soil moisture mean	1.757 (0.092)	1.488 (0.108)	-1.646	0.100
Soil moisture variance	0.185 (0.036)	0.079 (0.038)	-2.143	0.032

APPENDIX XXVI. GENERAL HABITAT DESCRIPTION OF *DIPODOMYS*
COMPACTUS. RELATIVE ABUNDANCE OF THIS SPECIES WAS
SUPERIMPOSED ONTO
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT
GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS
WHERE THIS SPECIES WAS CAPTURED WERE
SURROUNDED BY MINIMUM
CONVEX POLYGONS.

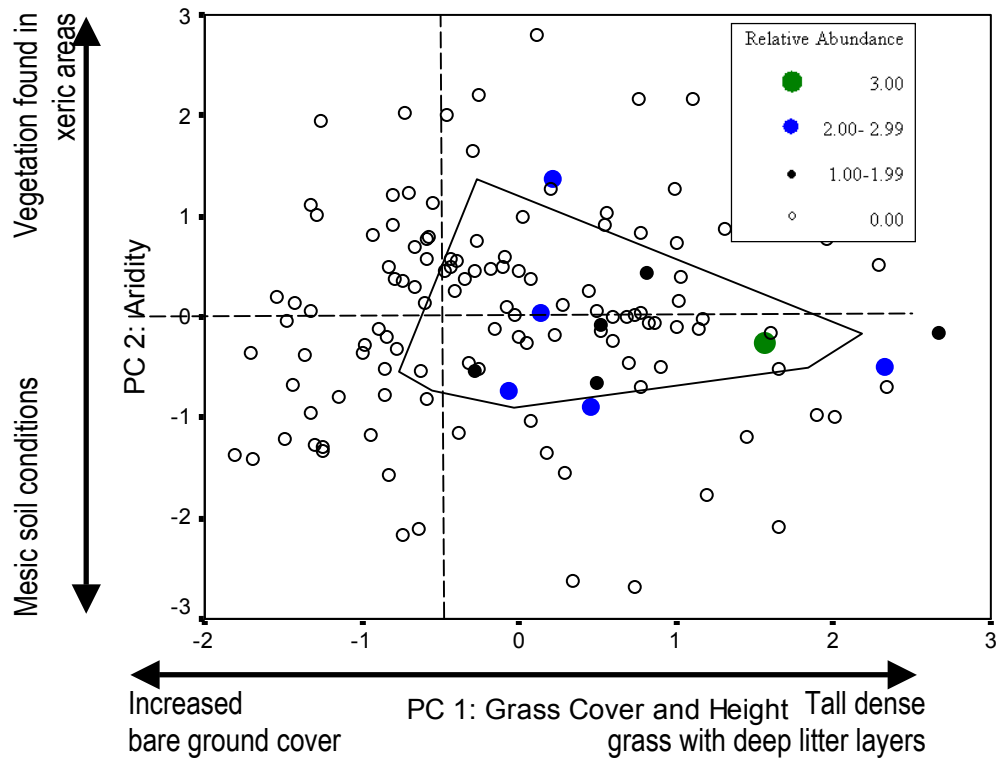


APPENDIX XXVII. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TESTS
BETWEEN TRANSECTS WHERE *BAIOMYS TAYLORI* WAS PRESENT
AND ABSENT. MEANS (STANDARD ERROR) THAT WERE
STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

	<i>Baiomys taylori</i>		Z	P
	Absent (n = 128)	Present (n = 12)		
Grass cover	2.782 (0.096)	3.102 (0.237)	-1.418	0.156
Forb cover	1.51 (0.039)	1.588 (0.129)	-0.705	0.481
Gulf dune paspalum cover	1.468 (0.057)	1.888 (0.277)	-1.406	0.160
Sedge & rush cover	1.303 (0.074)	1.61 (0.232)	-2.815	0.005
Standing dead cover	1.142 (0.02)	1.108 (0.048)	-0.154	0.878
Litter cover	1.177 (0.021)	1.063 (0.036)	-2.251	0.024
Standing water cover	1.069 (0.024)	1 (0)	-1.592	0.111
Bare ground cover	2.594 (0.118)	1.6 (0.18)	-2.562	0.010
Other cover	1.128 (0.041)	1.225 (0.129)	-0.780	0.435
Canopy height mean	3.365 (0.28)	6.233 (0.97)	-2.960	0.003
Canopy height variance	15.758 (4.007)	20.406 (4.463)	-2.785	0.005
Litter depth mean	0.449 (0.073)	1.613 (0.555)	-2.325	0.020
Litter depth variance	1.31 (0.369)	4.41 (1.665)	-2.407	0.016
RP mean	13.335 (0.602)	17.139 (1.468)	-2.088	0.037
RP variance	46.279 (4.069)	53.212 (10.129)	-1.310	0.190
Soil moisture mean	1.643 (0.077)	2.033 (0.206)	-2.040	0.041
Soil moisture variance	0.136 (0.029)	0.333 (0.11)	-2.182	0.029

APPENDIX XXVIII. GERERAL HABITAT DESCRIPTION OF *BAIOMYS TAYLORI*.

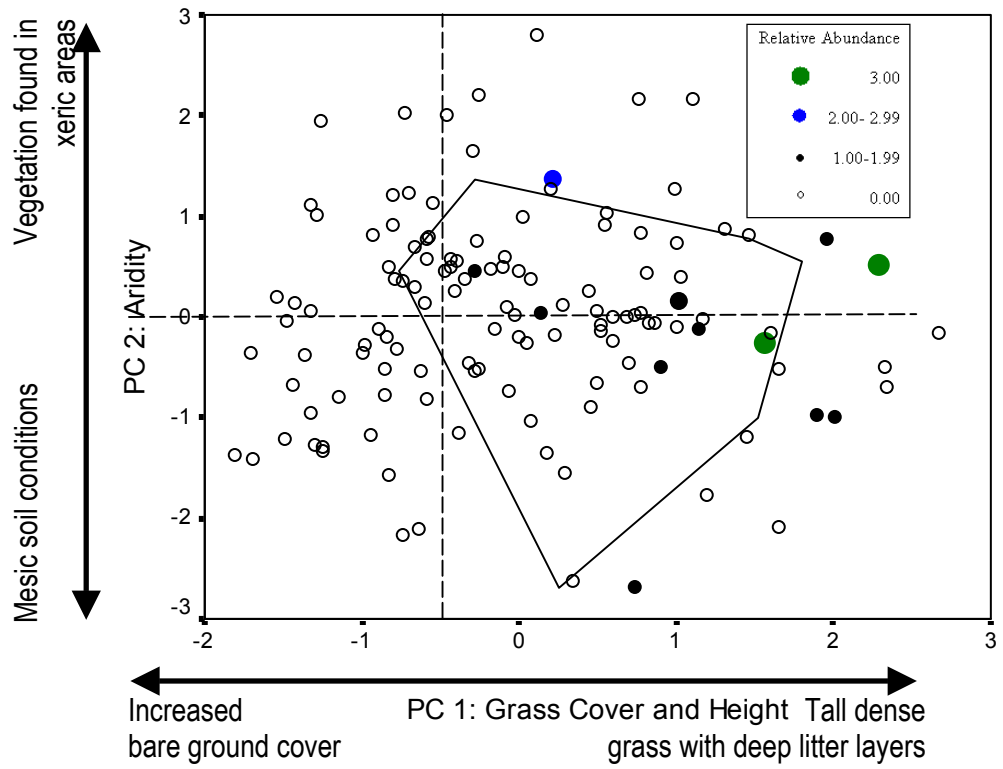
RELATIVE ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED
ONTO PRINCIPAL COMPONENTS 1 (GRASS COVER AND
HEIGHT GRADIENT) AND 2 (ARIDITY GRADIENT).
TRANSECTS WHERE THIS SPECIES WAS
CAPTURED WERE SURROUNDED
BY MINIMUM CONVEX
POLYGONS.



APPENDIX XXIX. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TESTS
BETWEEN TRANSECTS WHERE *REITHRODONTOMYS FULVESCENS*
WAS PRESENT AND ABSENT. MEANS (STANDARD ERROR)
THAT WERE STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

<i>Reithrodontomys fulvescens</i>				
	<i>Absent (n = 127)</i>	<i>Present (n = 13)</i>	<i>Z</i>	<i>P</i>
Grass cover	2.722 (0.092)	3.669 (0.272)	-2.998	0.003
Forb cover	1.509 (0.04)	1.588 (0.091)	-1.089	0.276
Gulf dune paspalum cover	1.46 (0.058)	1.935 (0.221)	-2.276	0.023
Sedge & rush cover	1.327 (0.076)	1.35 (0.151)	-1.716	0.086
Standing dead cover	1.145 (0.02)	1.083 (0.046)	-1.126	0.260
Litter cover	1.169 (0.022)	1.144 (0.045)	-0.147	0.883
Standing water cover	1.064 (0.024)	1.06 (0.05)	-0.612	0.541
Bare ground cover	2.625 (0.117)	1.367 (0.145)	-3.821	0.000
Other cover	1.149 (0.043)	1.004 (0.004)	-2.959	<0.001
Canopy height mean	3.257 (0.273)	7.066 (0.883)	-3.735	<0.001
Canopy height variance	15.679 (3.972)	20.816 (8.413)	-1.742	0.082
Litter depth mean	0.414 (0.068)	1.863 (0.52)	-3.222	0.001
Litter depth variance	1.433 (0.399)	2.97 (0.844)	-3.178	0.001
RP mean	12.945 (0.575)	20.651 (1.49)	-3.791	<0.001
RP variance	48.084 (4.169)	35.046 (4.442)	-0.226	0.821
Soil moisture mean	1.662 (0.077)	1.815 (0.231)	-1.274	0.203
Soil moisture variance	0.125 (0.027)	0.423 (0.137)	-3.809	<0.001

APPENDIX XXX. GERERAL HABITAT DESCRIPTION OF *REITHRODONTOMYS*
FULVESCENS. RELATIVE ABUNDANCE OF THIS SPECIES WAS
SUPERIMPOSED ONTO PRINCIPAL COMPONENTS 1 (GRASS
COVER AND HEIGHT GRADIENT) AND 2 (ARIDITY
GRADIENT). TRANSECTS WHERE THIS
SPECIES WAS CAPTURED WERE
SURROUNDED BY MINIMUM
CONVEX POLYGONS.



APPENDIX XXXI. HABITAT COMPARISONS BASED ON MANN-WHITNEY U
TESTS BETWEEN TRANSECTS WHERE *ONYCHOMYS LEUCOGASTER*
WAS PRESENT AND ABSENT. MEANS (STANDARD ERROR)
THAT WERE STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

	<i>Onychomys leucogaster</i>			
	<i>Absent (n = 131)</i>	<i>Present (n = 9)</i>	<i>Z</i>	<i>P</i>
Grass cover	2.828 (0.091)	2.542 (0.443)	-0.693	0.489
Forb cover	1.528 (0.038)	1.356 (0.177)	-1.762	0.078
Gulf dune paspalum cover	1.535 (0.061)	1.047 (0.047)	-2.781	0.005
Sedge & rush cover	1.351 (0.075)	1.003 (0.003)	-1.915	0.055
Standing dead cover	1.143 (0.02)	1.092 (0.061)	-1.025	0.305
Litter cover	1.164 (0.021)	1.214 (0.082)	-0.334	0.738
Standing water cover	1.068 (0.023)	1 (0)	-1.363	0.173
Bare ground cover	2.465 (0.113)	3.133 (0.522)	-1.249	0.211
Other cover	1.097 (0.018)	1.7 (0.542)	-1.216	0.224
Canopy height mean	3.705 (0.29)	2.233 (0.689)	-1.245	0.213
Canopy height variance	16.571 (3.925)	10.114 (3.848)	-0.608	0.543
Litter depth mean	0.56 (0.09)	0.379 (0.175)	-0.231	0.817
Litter depth variance	1.63 (0.396)	0.785 (0.358)	-0.171	0.864
RP mean	13.802 (0.574)	11.604 (3.081)	-0.964	0.335
RP variance	45.481 (3.828)	67.129 (20.328)	-1.249	0.212
Soil moisture mean	1.677 (0.076)	1.667 (0.289)	-0.082	0.934
Soil moisture variance	0.163 (0.03)	0 (0)	-1.729	0.084

APPENDIX XXXII. GERERAL HABITAT DESCRIPTION OF *ONYCHOMYS LEUCOGASTER*.

RELATIVE ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED ONTO

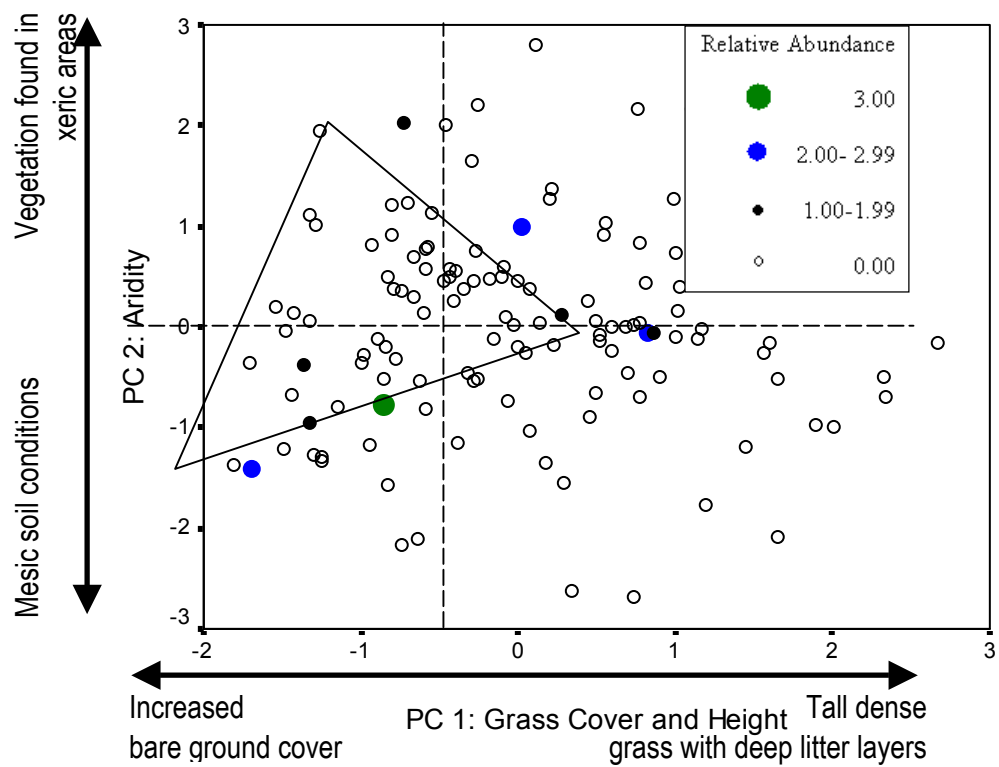
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT

GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS

WHERE THIS SPECIES WAS CAPTURED WERE

SURROUNDED BY MINIMUM

CONVEX POLYGONS.



APPENDIX XXXIII. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TEST
BETWEEN TRANSECTS WHERE *ORYZOMYS PALUSTRIS* WAS PRESENT
AND ABSENT. PRESENCE AND ABSENCE ON TRANSECTS WAS
DEFINED AS 0 AND 1 RESPECTIVELY. MEANS (STANDARD
ERROR) THAT WERE STATISTICALLY DIFFERENT
($P < 0.05$) ARE SHOWN IN BOLD.

	<i>Oryzomys palustris</i>		Z	P
	Absent (n = 138)	Present (n = 2)		
Grass cover	2.808 (0.092)	2.875 (0.156)	-0.345	0.730
Forb cover	1.512 (0.037)	1.733 (0.446)	-0.447	0.655
Gulf dune paspalum cover	1.512 (0.059)	1.15 (0.104)	-0.552	0.581
Sedge & rush cover	1.297 (0.069)	2.775 (0.39)	-2.901	0.004
Standing dead cover	1.141 (0.019)	1.058 (0.058)	-0.772	0.440
Litter cover	1.17 (0.02)	1.033 (0.033)	-1.235	0.217
Standing water cover	1.059 (0.022)	1.25 (0.126)	-2.565	0.010
Bare ground cover	2.537 (0.112)	1.217 (0.142)	-1.785	0.074
Other cover	1.138 (0.04)	1.033 (0.033)	-0.552	0.581
Canopy height mean	3.569 (0.279)	5.492 (1.949)	-1.159	0.246
Canopy height variance	15.936 (3.753)	26.229 (13.193)	-1.461	0.144
Litter depth mean	0.56 (0.087)	0.021 (0.011)	-1.631	0.103
Litter depth variance	1.61 (0.379)	0.014 (0.007)	-1.660	0.097
RP mean	13.536 (0.571)	19.356 (5.272)	-1.230	0.219
RP variance	46.402 (3.875)	68.395 (18.849)	-1.504	0.133
Soil moisture mean	1.644 (0.072)	3.15 (0.076)	-2.794	0.005
Soil moisture variance	0.145 (0.028)	0.539 (0.277)	-1.894	0.058

APPENDIX XXXIV. GERERAL HABITAT DESCRIPTION OF *ORYZOMYS PALUSTRIS*.

RELATIVE ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED ONTO

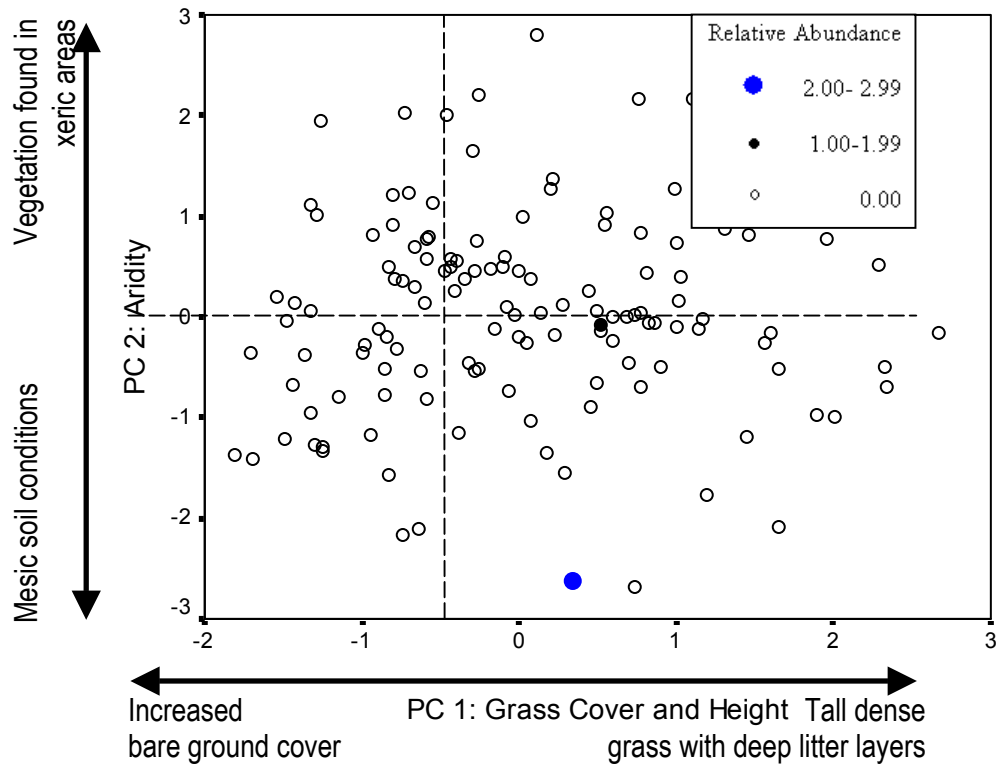
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT

GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS

WHERE THIS SPECIES WAS CAPTURED WERE

SURROUNDED BY MINIMUM

CONVEX POLYGONS.



APPENDIX XXXV. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TEST
BETWEEN TRANSECTS WHERE *SIGMODON HISPIDUS* WAS PRESENT
AND ABSENT. MEANS (STANDARD ERROR) THAT WERE
STATISTICALLY DIFFERENT ($P < 0.05$) ARE
SHOWN IN BOLD.

	<i>Sigmodon hispidus</i> (Padre Island)			
	<i>Absent</i> (<i>n</i> = 104)	<i>Present</i> (<i>n</i> = 36)	<i>Z</i>	<i>P</i>
Grass cover	2.723 (0.098)	3.059 (0.203)	-1.495	0.135
Forb cover	1.476 (0.041)	1.635 (0.082)	-1.652	0.098
Gulf dune paspalum cover	1.541 (0.067)	1.399 (0.113)	-2.070	0.038
Sedge & rush cover	1.293 (0.078)	1.433 (0.155)	-0.899	0.369
Standing dead cover	1.131 (0.021)	1.165 (0.042)	-0.502	0.616
Litter cover	1.153 (0.023)	1.207 (0.039)	-1.498	0.134
Standing water cover	1.08 (0.029)	1.016 (0.008)	-0.174	0.862
Bare ground cover	2.682 (0.13)	2.006 (0.19)	-2.941	0.003
Other cover	1.101 (0.02)	1.235 (0.141)	-0.142	0.887
Canopy height mean	2.986 (0.301)	5.415 (0.535)	-4.071	<0.001
Canopy height variance	10.259 (1.178)	33.191 (13.654)	-3.790	<0.001
Litter depth mean	0.388 (0.076)	1.014 (0.233)	-3.487	<0.001
Litter depth variance	1.543 (0.486)	1.671 (0.345)	-3.054	0.002
RP mean	11.997 (0.596)	18.468 (1.061)	-4.911	<0.001
RP variance	39.53 (3.736)	68.085 (9.426)	-3.080	0.002
Soil moisture mean	1.634 (0.088)	1.797 (0.122)	-1.710	0.087
Soil moisture variance	0.114 (0.029)	0.267 (0.066)	-3.164	0.002

APPENDIX XXXVI. GENERAL HABITAT DESCRIPTION OF *SIGMODON HISPIDUS*.

RELATIVE ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED ONTO

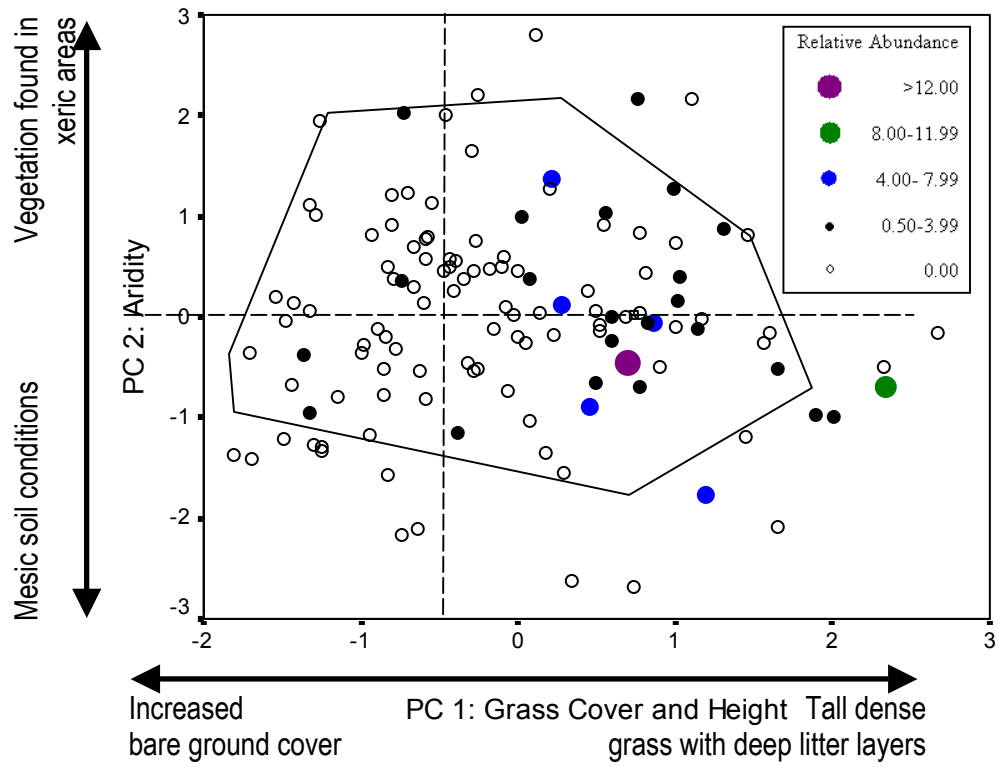
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT

GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS

WHERE THIS SPECIES WAS CAPTURED WERE

SURROUNDED BY MINIMUM

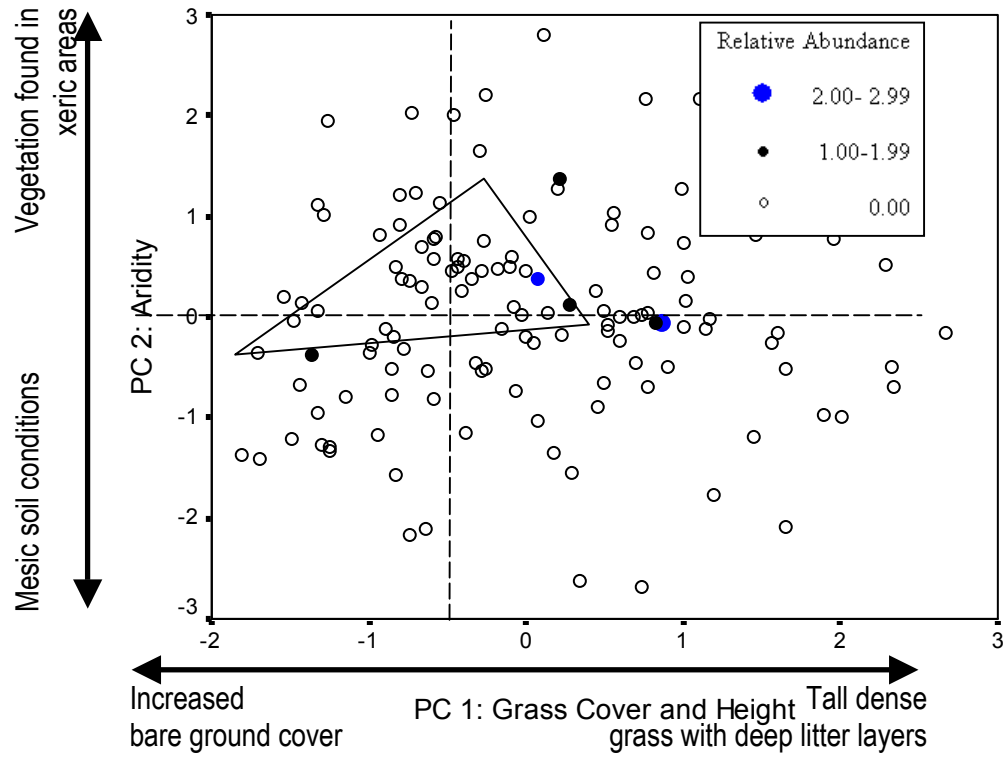
CONVEX POLYGONS.



APPENDIX XXXVII. HABITAT COMPARISONS BASED ON MANN-WHITNEY U TESTS
BETWEEN TRANSECTS WHERE *MUS MUSCULUS* WAS PRESENT
AND ABSENT. MEANS (STANDARD ERROR) THAT WERE
STATISTICALLY DIFFERENT ($P < 0.05$)
ARE SHOWN IN BOLD.

	<i>Mus musculus</i>		<i>Z</i>	<i>P</i>
	<i>Absent (n = 134)</i>	<i>Present (n = 6)</i>		
Grass cover	2.789 (0.092)	3.263 (0.442)	-1.312	0.190
Forb cover	1.523 (0.038)	1.379 (0.207)	-1.077	0.282
Gulf dune paspalum cover	1.527 (0.06)	1 (0)	-2.626	0.009
Sedge & rush cover	1.343 (0.073)	1.004 (0.004)	-1.355	0.175
Standing dead cover	1.14 (0.02)	1.117 (0.089)	-0.562	0.574
Litter cover	1.165 (0.021)	1.225 (0.082)	-1.156	0.248
Standing water cover	1.066 (0.023)	1 (0)	-1.100	0.271
Bare ground cover	2.486 (0.113)	3.004 (0.567)	-1.045	0.296
Other cover	1.138 (0.041)	1.096 (0.053)	-0.317	0.751
Canopy height mean	3.606 (0.288)	3.719 (0.687)	-0.659	0.510
Canopy height variance	16.192 (3.842)	15.353 (4.782)	-1.184	0.237
Litter depth mean	0.549 (0.088)	0.533 (0.241)	-0.591	0.555
Litter depth variance	1.592 (0.387)	1.226 (0.459)	-0.751	0.452
RP mean	13.456 (0.578)	18.244 (2.895)	-1.692	0.091
RP variance	44.384 (3.703)	102.473 (25.505)	-2.809	0.005
Soil moisture mean	1.684 (0.075)	1.5 (0.224)	-0.266	0.790
Soil moisture variance	0.16 (0.029)	0 (0)	-1.395	0.163

APPENDIX XXXVIII. GERERAL HABITAT DESCRIPTION OF MUS MUSCULUS. RELATIVE
ABUNDANCE OF THIS SPECIES WAS SUPERIMPOSED ONTO
PRINCIPAL COMPONENTS 1 (GRASS COVER AND HEIGHT
GRADIENT) AND 2 (ARIDITY GRADIENT). TRANSECTS
WHERE THIS SPECIES WAS CAPTURED WERE
SURROUNDED BY MINIMUM
CONVEX POLYGONS.



MANAGEMENT RECOMMENDATIONS

I. Exotic Species

1. Ungulates.—Presence of exotic ungulates such as nilgai and feral pigs should be monitored. All exotic ungulates should be removed from PAIS as quickly as possible to prevent establishment of populations.

2. Nutria.—Wetland habitats should be periodically monitored for presence of nutria. Nutria should be removed from PAIS as quickly as possible to prevent establishment of populations.

3. Rodents.—Presence, distribution, and abundance of exotic rodents (i.e., roof rat, Norway rat, and house mouse) should be monitored. These species likely are unintentionally introduced through transport on vehicles and boats. Thus, populations of these species might first become established at areas with heavy vehicle use and human presence, such as the headquarters and visitor areas, Bird Island Basin recreation area, campgrounds, turtle cabin, and Mansfield Channel. However, populations are capable of expanding from these sources to adjacent habitats, especially in the case of the house mouse. An effort should be made to eliminate all populations of exotic rodents. Further, to prevent establishment of new populations, means should be developed for reducing potential for unintentional vehicular transport.

4. Domestic mammals.—The park should continue to prohibit domestic livestock. Any free ranging domestic livestock that colonize PAIS should be immediately removed. The park should continue to require that domestic pets (e.g., dogs, cats, ferrets, gerbils) be confined to cages or maintained on leashes. Any free ranging domestic pets should be immediately removed from PAIS.

II. Extirpated Species

1. Red wolf.—The red wolf is a federally listed endangered species that historically occurred on Padre Island. Thus, feasibility of red wolf reintroduction to PAIS should be explored. As a top carnivore, presence of the red wolf likely was important in structuring the overall mammal community and greater ecosystem functioning on the island. In particular, it is likely that presence of the red wolf functioned to reduce coyote populations, resulting in increased density of mesocarnivores and hence altered structure of the entire mammal community and other aspects of the ecosystem.

2. Hog-nosed skunk.—The presence of the hog-nosed skunk within PAIS is unconfirmed, although it seems likely that it was a historical member of the

mammal fauna. The status of this species in Texas is uncertain, but it may have been extirpated. Thus, feasibility of hog-nosed skunk reintroduction to PAIS should be explored. Such a reintroduction should consider the need for control of high densities of coyotes, which likely prey on hog-nosed skunks.

3. Rodents.—Two species of rodents, the hispid pocket mouse and Merriam's pocket mouse, historically occurred on Padre Island but appear to have been extirpated from PAIS. Feasibility of reintroduction of these species to southern PAIS should be explored in order to re-establish the original mammalian diversity. The most suitable source populations would be from northern South Padre Island.

III. Natural Disturbance

The mammal fauna and ecosystems of Padre Island evolved with a range of disturbances such as wildfire and hurricanes. Thus, the natural range of disturbance should be allowed to influence PAIS. In particular, fire likely was an important force in nutrient cycling and providing a diversity of habitats. Thus, natural or controlled fire should be included as an important aspect of habitat management.

IV. Coyote Management

Densities of coyotes within PAIS appeared high, although additional species-specific studies are needed to quantify this observation. Reasons for high coyote densities might include removal of red wolf, natural marine food subsidies, and food subsidies provided by human activities. Human activities also might influence other aspects of coyote behavior and demography within PAIS. For example, coyotes were observed to scavenge on food remains at campsites and to retrieve fish carcasses discarded on the beach by anglers. Such behaviors can result in problems associated with human-tolerant individuals as well as shifts in ecosystem structuring that might result from artificially inflated coyote populations. Thus, efforts should be made to develop mechanisms and policies for reducing coyote reliance on humans, particularly with regards to controlling access to garbage and fishing waste (dumping bait and fish remains).

V. Additional Study

Some mammal species are either naturally rare or only intermittently present on North Padre Island, particularly bats and carnivores, making documentation with verifiable evidence difficult and largely subject to chance encounters. Thus, all effort should be made to document these species with verifiable evidence (e.g., preserved carcasses or other remains deposited in a museum, photographs depicting key

characteristics, etc.), as opportunities arise. Because of the potential for several rare or endangered carnivores to occur within PAIS (e.g., ocelot, cougar, jaguarondi, jaguar), PAIS should consider initiating a long-term carnivore monitoring program using remote cameras. Further, given concern about effects of carnivores on breeding birds on small islands within the Laguna Madre, a research program should be developed to assess carnivore use of these islands and relation with breeding colonial water birds. A research program also should be developed to study coyote food habits in relation to breeding birds, natural and anthropogenic subsidies, and behavioral interactions with human activities. Radio tracking methods will be particularly relevant for studies of coyote behavior.