

**EVALUATION OF COLLARED PECCARY TRANSLOCATIONS  
IN THE TEXAS HILL COUNTRY**

A Thesis

by

BRAD ALAN PORTER

Submitted to the Office of Graduate Studies of  
Texas A&M University  
in partial fulfillment of the requirements for the degree of  
MASTER OF SCIENCE

May 2006

Major Subject: Wildlife and Fisheries Sciences

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Approved by:

Chair of Committee,	Roel R. Lopez
Committee Members,	Nova J. Silvy
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**ABSTRACT**

Evaluation of Collared Peccary Translocations in the Texas Hill Country.

(May 2006)

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Chair of Advisory Committee: Dr. Roel R. Lopez

Historically, the collared peccary (*Tayassu tajacu*) occurred throughout much of Texas including the northern portion of the Texas Hill Country. Remaining peccary populations were extirpated in much of their former range due to over harvest and habitat loss. In 2004, efforts to restore peccary populations to the Texas Hill Country began when Texas Parks and Wildlife Department biologists translocated 29 collared peccaries into the 2,157 ha, Mason Mountain Wildlife Management Area (MMWMA). I evaluated the success of peccary translocations for mixed and intact family groups by comparing survival, ranges, and dispersal of translocated, radio-tagged peccaries. In addition, I evaluated two release methods (soft versus hard) to determine differences in population demographics. I found that peccary ranges and dispersal patterns did not differ ( $P > 0.05$ ) between intact and mixed groups or release method (soft versus hard). However, I did find that peccary fidelity to release sites was greater for soft releases of family groups. Individuals from the soft release group dispersed the shortest distance and stayed on MMWMA. Only 2 individuals from the hard releases stayed on MMWMA while the rest (19 individuals) dispersed 4-8 km. Future peccary translocations should emphasize the release method employed and family structure of individuals released to improve translocation effectiveness in establishing populations in target areas.

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## INTRODUCTION

Collared peccaries (*Tayassu tajacu*) are small, pig-like mammals native to arid regions of the southwestern United States (Hellgren and Lochmiller 2000). In Texas, collared peccaries once ranged throughout much of the state, including the Edwards Plateau Region of the Texas Hill Country (Figure 1, Texas Game, Fish and Oyster Commission 1945). Historic population declines of peccary populations occurred in many regions of the state due to several limiting factors such as overharvest and habitat loss, and were extirpated in some areas (e.g., Edwards Plateau, Texas Game, Fish and Oyster Commission 1945, Sowls 1997). Regulated hunting and habitat restoration has resulted in peccary population increases in some areas of the state such as the South Texas Brush Country (Sowls 1997, Hellgren and Lochmiller 2000); however, other areas have not observed peccary recoveries due to a lack of source populations. In 2004, Texas Parks and Wildlife Department (TPWD) biologists began efforts to restore collared peccaries into the Edwards Plateau Region of the Texas Hill Country using translocations. The potential benefits of translocations include establishing source populations (Nielsen 1988) for the further expansion of peccaries into their historic range. The usefulness of translocations in the restoration of collared peccaries, however, has not been evaluated.

Translocations have been used in the restoration of mid- to large-sized mammal populations in many areas of the United States (Nielsen 1988). For example, use of translocations for Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), bison (*Bison*



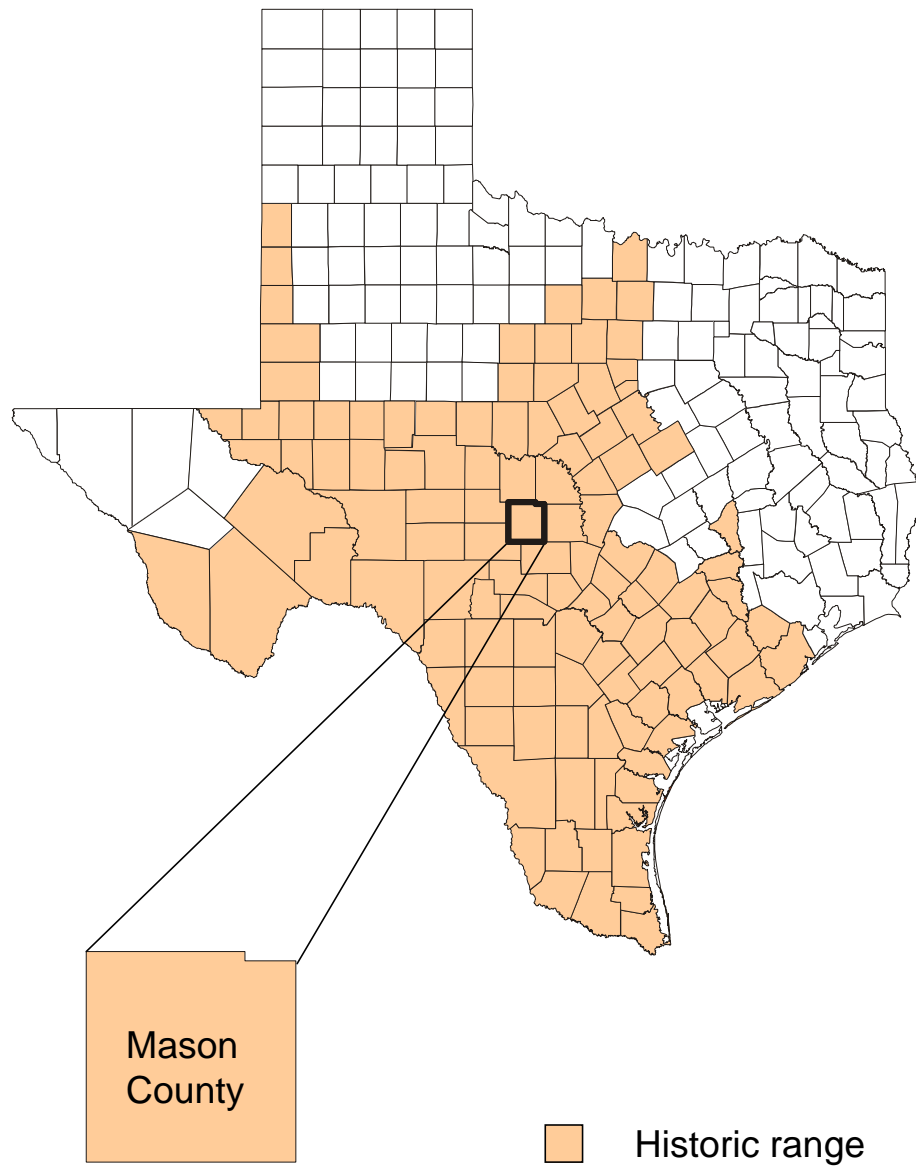


Figure 1. Historic distribution of collared peccaries in Texas. Mason County was the translocation site in my study.

*bison*), caribou (*Rangifer tarandus*), bighorn sheep (*Ovis canadensis*), elk (*Cervus elaphus*), and pronghorn (*Antilocapra americana*) were successful in restoring self-sustaining populations into native ranges (Franzmann 1988, Griffith et al. 1989, Wolf et al. 1996). The success of translocations in restoring native game populations is dependent on several factors including the initial numbers of animals to release, holding time during transport, or holding time prior to release (Nielsen 1988). For the latter, the holding time prior to release (i.e., “soft” versus “hard” release) can have significant effects on the overall success of translocated animals for factors such as survival or fidelity to release site (Davis 1983, Bright and Morris 1994, Biggins et al. 1999, Letty et al. 2000, Eastridge and Clark 2001, Truett et al. 2001). The term “soft release” refers to the release of translocated animals following an acclimation period in a holding facility at the release site for variable length of time (Nielsen 1988). The primary function of soft releases is to allow animals to acclimate to their new surroundings prior to release (Bright and Morris 1994, Letty et al. 2000, Wanless et al. 2002). Conversely, the term “hard release” refers to the release of translocated animals immediately after arrival at the release site (Nielsen 1988). Previous studies (e.g., Davis 1983, Letty et al. 2000) have reported that soft releases can increase animal survival and fidelity to release sites. The importance of soft versus hard releases in the translocation of collared peccaries, however, has not been evaluated.

Past studies also have reported the initial number of animals released also may be an important factor in determining translocation success (Nielsen 1988, Griffith et al. 1989, Wolf et al. 1998). This may be particularly important for collared peccaries,

which are a gregarious species that live in herds (Robinson 1985). These social units or family groups are an important survival strategy for collared peccaries, which provides safety from predation during foraging activities (Robinson 1985). Oldenburg (1985) noted that herd territories may overlap, but peccaries from different herds usually do not exchange members or intermingle. Conversely, research also has shown that family group structure can be “restructured” with some individual losses if mixed individuals are confined for a 2–4 week period (D. Synatzske, TPWD, unpublished data). Thus, in the development of translocation protocols for collared peccaries, the importance of group structure (i.e., intact family group versus mixed group) also needs to be evaluated. The translocation of mixed individuals instead of the capture of entire family groups would be easier to implement, but may not be effective in the long-term. Such information would be useful in future peccary translocations.

### **Objectives**

My study objective is to evaluate the effectiveness of collared peccary translocations into the Edwards Plateau Region of Texas. Specifically, I will evaluate the success of translocations by comparing survival and movements between method of release (i.e., “hard” versus “soft”) and group structure (i.e., intact group versus solitary animals). I propose the following hypotheses: (1) survival will increase with use of soft releases of intact groups as opposed to hard releases of individuals from mixed groups, and (2) dispersal from release site will decrease for soft releases of intact groups as opposed to hard releases of individuals from mixed groups.

## **METHODS**

### **Study area**

Mason Mountain Wildlife Management Area (MMWMA) is approximately 2,157 ha, located in the Edwards Plateau Ecological Region of the Texas Hill Country (Figure 1). This area is characterized by sandy to gravelly soils, supporting mixed open woodland and brushland plant communities. Dominant woody vegetation includes post oak (*Quercus stellata*), blackjack oak (*Q. marilandica*), Plateau live oak (*Q. fusiformes*), mesquite (*Prosopis glandulosa*), and whitebrush (*Aloysia gratissima*). The herbaceous community is dominated by three-awns (*Aristida* spp.), little bluestem (*Schizachyrium scoparium*), Texas wintergrass (*Nassella leucotricha*), yellow indiagrass (*Sorghastrum nutans*), buffalograss (*Buchloë dactyloides*), and various forbs. Numerous abandoned agricultural fields of 1–14 ha are interspersed throughout the area. Field vegetation is dominated by perennial forbs and grasses. The area was historically grazed by cattle and currently maintains populations of large, exotic mammals (M. Mitchell, TPWD, personal communication).

### **Trapping and translocation**

Trapping was conducted by TPWD personnel in February – April, 2004. Peccaries were live-trapped in Choke Canyon State Park (CCSP) and on the Chaparral Wildlife Management Area (CWMA) in south Texas. Collared peccaries were trapped using a variety of techniques including corral traps and aluminum box traps (Neal 1959). Corral traps were constructed from welded wire panels and metal posts. Corral traps were approximately 5 x 8 m. Corn was used as bait and a trap door was closed manually

by a long pull rope when a desired group of peccaries was observed in the trap.

Trapping occurred during early morning and late evening when peccaries were normally active. Aluminum box traps were approximately 1 x 1 x 3 m. Aluminum box traps were baited with corn, set in the evening, and checked each morning.

Upon capture, peccaries were physically restrained using a pole snare. A loop was placed behind the upper canine teeth and drawn tight while a second person held the hind legs of the peccary. Captured peccaries were loaded into a trailer and transported to the MMWMA release site. Prior to release into a holding pen (soft release) or into the management area (hard release), each peccary was marked with battery-powered mortality-sensitive radio transmitter attached to an ear tag (Appendix A, 150-152 MHz, 20 g, Advanced Telemetry Systems, Isanti, Minnesota). The transmitter/ear tag system weighed <3% of each peccary's body weight, well within the 5% threshold recommended by the American Society of Mammalogists. Additionally, peccaries were marked with numbered and color-coded ear-tags. Sex and age was recorded at the time of capture prior to release.

I translocated 29 collared peccaries in 3 treatment groups: (1) intact family group, soft release (GSR, 2 males, 6 females), (2) intact family group, hard release (GHR, 3 males, 4 females), and (3) mixed family group, hard release (MHR, 5 males, 9 females) (Table 1). Translocated peccaries were moved over a 1–3-month period in fall 2004. For GSR peccaries, animals were held in a 1-ha pen for 10 days.

Table 1. Demographics of radio-tagged translocated collared peccaries by sex, group, and release type, released into the Mason Mountain Management Area, Mason, Texas, 2004.

Group/Release <sup>a</sup>	Fate		
	Alive	Censored	Dead
Sex			
GSR			
Female	1	4	1
Male	1	1	0
GHR			
Female	0	4	0
Male	0	3	0
MHR			
Female	0	9	0
Male	0	5	0

<sup>a</sup>GSR = intact family group, soft release, GHR = intact family group, hard release, and MHR = mixed family group, hard release.

### Radiotelemetry

Following release, radio-tagged peccaries were monitored 2–5 times/week for 6 months via homing and triangulation (White and Garrott 1990). Animals were censored after their last known encounter if radios failed or could not be located (Pollock et al. 1989). Any detected mortality was immediately located, and cause of mortality determined. Telemetry locations were entered into ArcView GIS (Version 3.3) and Microsoft Access to calculate ranges and dispersal.

### **Data analysis**

Due to the high censored (Pollock et al. 1989) and low mortalities observed in my study (Table 1), survival was not calculated using a Kaplan-Meier estimator. Instead, I calculated the rate of loss (i.e., change in the number of animals at risk on the study area) by treatment group using simple linear regression for a 6-month period. I compared the number of animals at risk by month using scatter plots (Ott 1993). The slope of each line was calculated to compare the number of animals lost and observed mortalities from the release site for each treatment group.

I calculated 6-month ranges (95% probability area) and core areas (50% probability area) using a fixed-kernel home-range estimator from radio locations (Worton 1989, Seaman et al. 1998, Seaman et al. 1999) with the animal movement extension in ArcView GIS, Version 3.3 (Hooge and Eichenlaub 1999). I only used peccaries with  $\geq 10$  locations in calculating 6-month ranges. Ranges and core area estimates were compared among treatment groups using an ANOVA (Ott 1993). Finally, I estimated the maximum dispersal distance (i.e., farthest known dispersal point recorded from release site) for each individual peccary using Euclidean distances; median maximum distance estimates were calculated for each treatment group.

## RESULTS

### Survival

I observed 1 mortality from the GSR group in my study (Table 1). The number of censored animals (i.e., left the study site) was high ( $n = 26$ , Table 1, Appendix A). The rate of loss (number of peccaries leaving/dying on study area/month) by treatment was lowest for the GSR peccaries (-0.885) followed by the GHR (-1.257) and MHR (-3.314) peccaries (Figure 2). Rate of loss suggests family group and method of release were important in predicting peccary survival and fidelity to release site.

### Ranges

A total of 13 (GSR,  $n = 6$ ; GHR,  $n = 3$ ; MHR,  $n = 4$ ) radio-tagged collared peccaries met my criteria in calculating 6-month ranges and core area estimates. Low sample sizes were due to the abnormally high number of censored animals in my study. Average 6-month range estimates ( $\pm 1$  SE) were as follows: GSR =  $252 \pm 32$  ha, GHR =  $828 \pm 661$  ha, and MHR =  $427 \pm 171$  ha; average core area estimates were as follows: GSR =  $39 \pm 7$  ha, GHR =  $157 \pm 129$  ha, and MHR =  $64 \pm 27$  ha (Figure 3). I found that group type and release method were not important ( $P = 0.139-0.361$ ) in predicting peccary 6-month ranges and core areas.

### Dispersal

A total of 8 (GSR,  $n = 6$ ; GHR,  $n = 2$ ; MHR,  $n = 0$ ) radio-tagged peccaries stayed on MMWMA for the duration of the study while 21 (GSR,  $n = 2$ ; GHR,  $n = 5$ ; MHR,  $n = 14$ ) left the study area (Figure 4). A total of 13 (GSR,  $n = 6$ ; GHR,  $n = 3$ ; MHR,  $n = 4$ ) radio-tagged peccaries met my criteria in calculating maximum dispersal distance.



Median maximum dispersal distances by group and release type were as follows: GSR = 2,049 m, GHR = 2,147 m, MHR = 3,023 m (Figure 5).

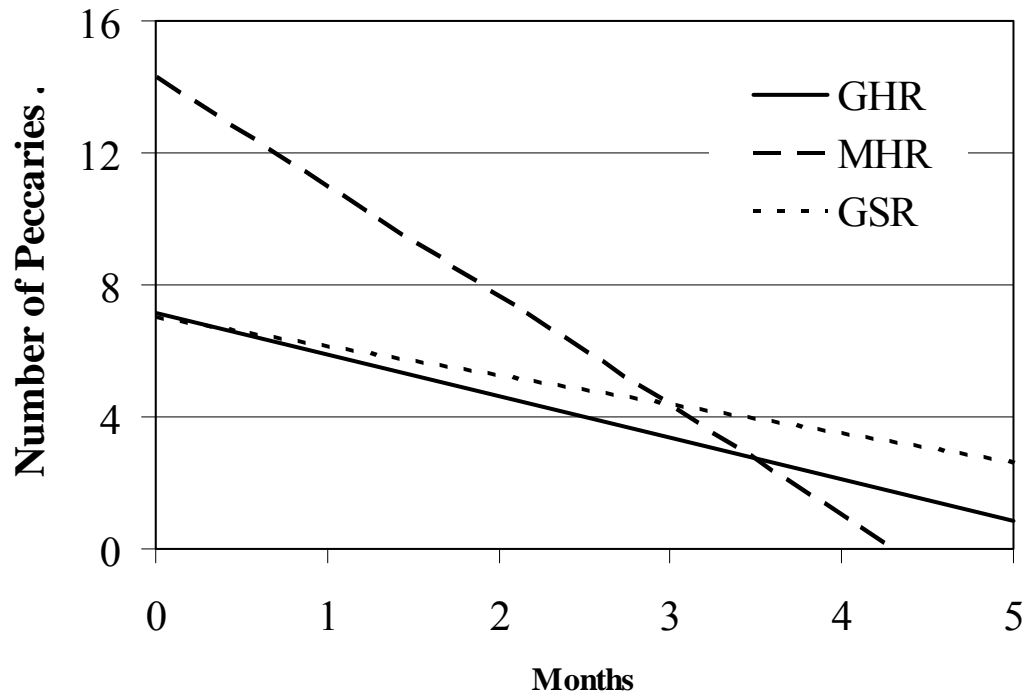


Figure 2. Rate of loss of translocated collared peccaries at Mason Mountain Wildlife Management Area by group and release type (family group/soft release [GSR], family group/hard release [GHR], mixed group/hard release [MHR]), Mason, Texas, March–August 2004.

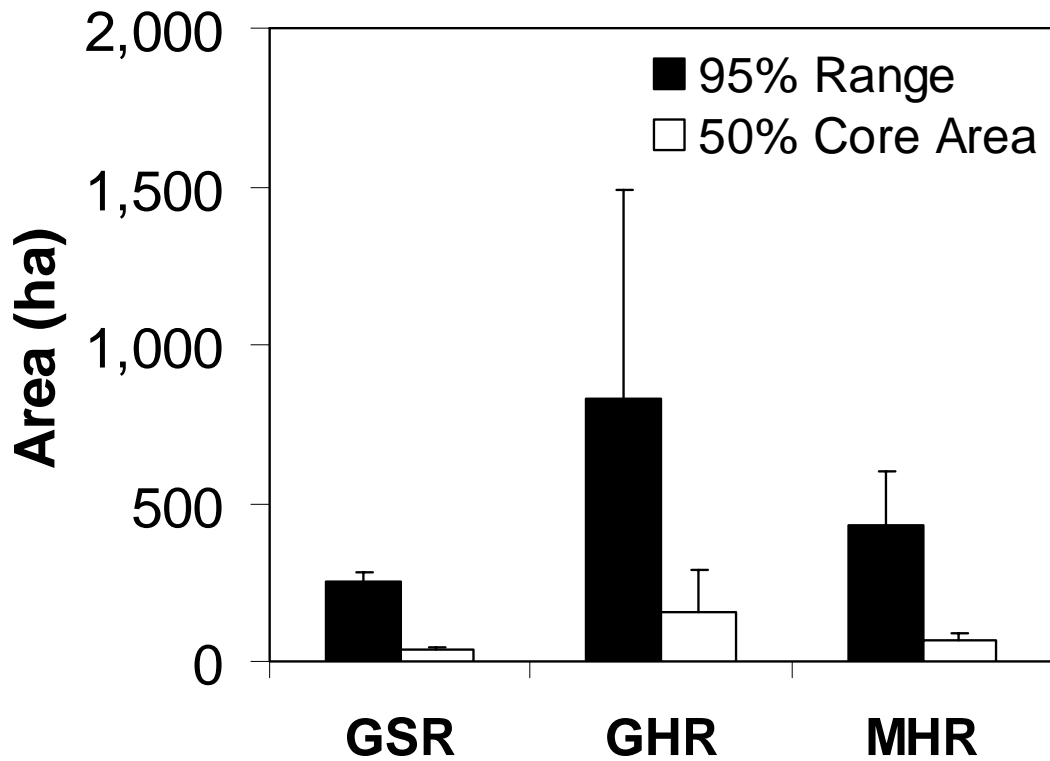


Figure 3. Translocated collared peccary 6 month ranges (mean 95% and 50% core areas, 1 SE, ha) by group/release type (family group/soft release [GSR], family group/hard release [GHR], mixed group/hard release [MHR]), Mason Mountain Wildlife Management Area, Mason, Texas, 2004.

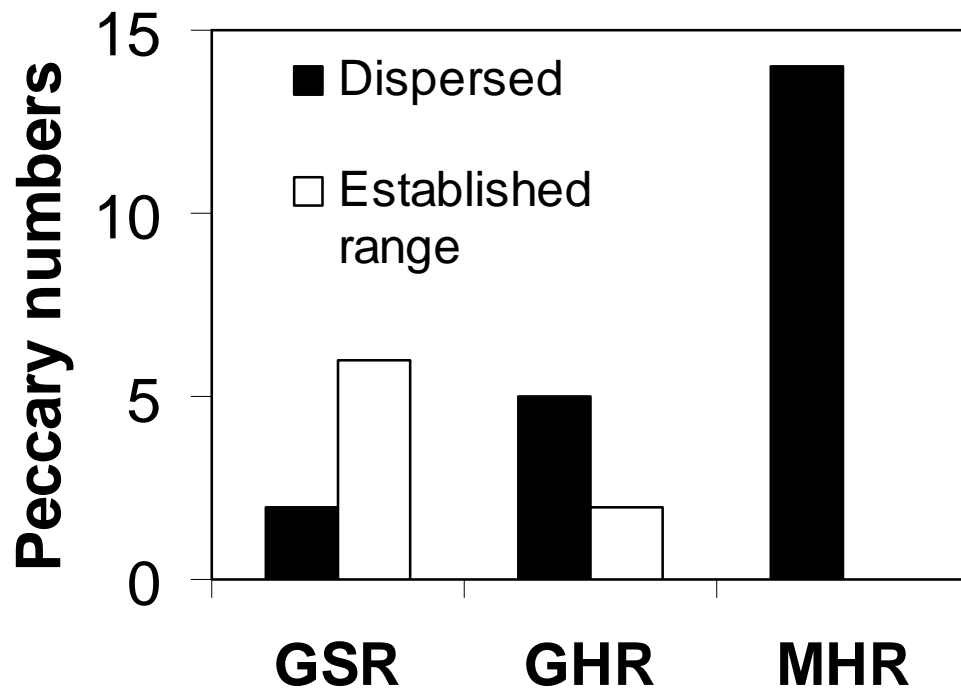


Figure 4. Translocated collared peccary that dispersed (left Mason Mountain Wildlife Management Area [MMWMA], 2,145 ha) or established range on MMWMA by group/release type (family group/soft release [GSR], family group/hard release [GHR], mixed group/hard release [MHR]), Mason, Texas, 2004.

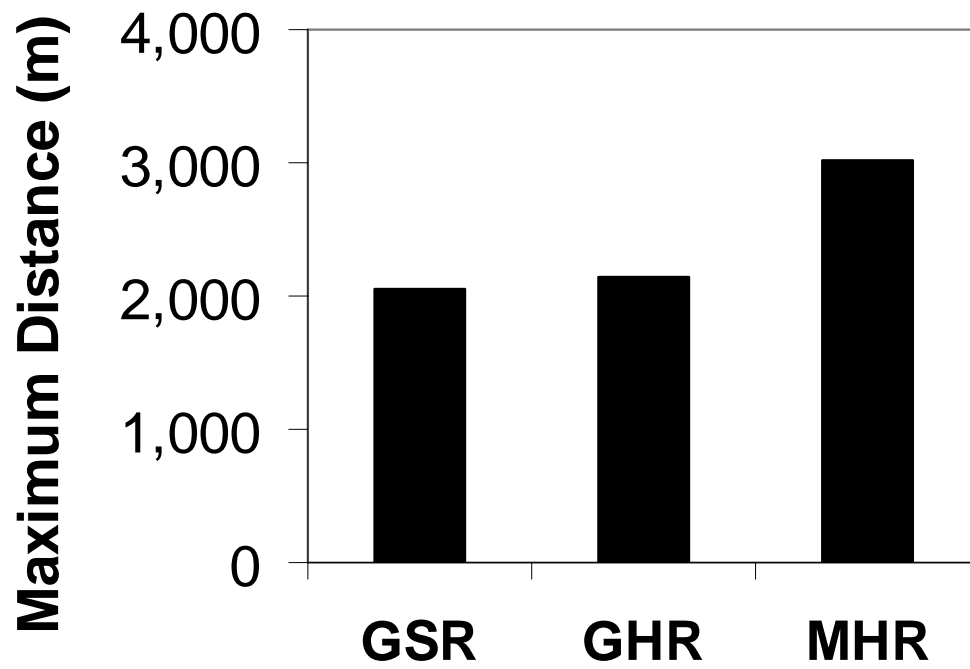


Figure 5. Median maximum dispersal distances (m) for translocated collared peccaries by group/release type (family group/soft release [GSR], family group/hard release [GHR], mixed group/hard release [MHR]), Mason Mountain Wildlife Management Area, Mason, Texas, 2004.

## DISCUSSION

### Survival

I found that GSR and GHR peccaries had comparable, low rates of loss from the release site as compared to the MHR group (Figure 2). As predicted, my data suggests that family structure and release type of collared peccaries were important factors in the overall success of peccary translocations (i.e., increased survival and fidelity to release site). My study results were similar to other studies that evaluated release type in translocation success. For example, Bright and Morris (1994) and Wanless et al. (2002) reported soft releases of dormice (*Muscardinus avellanarius*) and flightless Aldabra rail (*Dryolimnas [cuvieri] aldabranus*) had higher survival compared to hard releases. Similarly, Eastridge and Clark (2001) found that soft releases of black bear (*Ursus americanus*) also increased survival in a restoration program in Kentucky and Tennessee. My data also suggests that family structure of translocated individuals is an important factor in the success of peccary translocations. My findings are similar to those reported by Novellie et al. (1996) that found family group releases increased survival for the Cape mountain zebra (*Equus zebra zebra*). I proposed that future translocations of collared peccaries should attempt to include the capture and translocation of family groups as opposed to mixed individuals, and use of soft releases as opposed to hard releases. I attribute the increased survival and fidelity to release site observed in my study to stronger social cohesion and acclimation which reduces prospecting behavior and homing tendencies (Davis 1983, Bright and Morris 1994).

## **Ranges**

I found that 6-month range and core area estimates did not differ by group type or release method; however, the GSR peccaries had the smallest ranges and core areas with a majority of individuals staying on the management area (Table 1). Contrary to expected, I found that GHR had slightly higher ranges and core areas compared to MHR. This suggests that release method may be more important factor in peccary translocations than group type. In comparing ranges estimates of translocated peccaries to those reported by Gabor and Hellgren (1999) for resident peccaries in South Texas (range –116 ha, core area – 15 ha), translocated ranges were 3-4 times larger. Larger ranges are likely due to release type, particularly hard releases, into new environments. Previous studies (Davis 1983, Eastridge and Clark 2001) report that smaller ranges/movements were attributed to soft releases. For example, Davis (1983) found ranges to be significantly less for soft released martens (*Martes americana*) in Wisconsin. Study findings suggest that the use of soft releases will likely decrease the ranges of translocated peccaries. I recommend future translocations place an emphasis on soft releases for collared peccaries.

## **Dispersal**

I found that release type and to a lesser degree family group were important factors in increasing the fidelity of translocated peccaries to release sites. I observed 19 of 21 peccaries hard released left the management area within 1–2 weeks and dispersed 4–8 km. Conversely, I found that soft released peccaries returned several times to the acclimation pens to take advantage of supplemental food that continued to be available

2-3 months following release. Letty et al. (2000) evaluated success of translocated European wild rabbits (*Oryctolagus cuniculus*) and reported that soft releases increased fidelity to release sites by reducing initial prospecting behavior. Other studies have reported that dispersal distances for soft releases were smaller compared to hard releases (Bright and Morris 1994, Biggins et al. 1999, Truett et al. 2001, Wanless et al. 2002). Bright and Morris (1994) concluded that soft released dormice (*Muscardinus avellanarius*) traveled less than those hard released, and reported that differences in dispersal distance due to release type are of major importance in translocations because dispersal from release sites compromises establishment of cohesive populations and the ability to benefit from supplemental food. Reducing dispersal from release sites are preferred in ensuring the overall success of peccary translocations. For example, due to the game species status and harvest regulations of collared peccaries in Texas, protection of dispersing peccaries from release sites is difficult and can ultimately result in the failure of those releases. Thus, release type is an important factor to consider in future peccary translocations in the state and elsewhere.

## **SUMMARY**

I recommend that future collared peccary translocations consider release type and to a lesser degree family structure of translocated animals. I found that release type was important factor in establishing site fidelity and increasing survival in peccary translocations, 2 factors critical to their overall success. The relative importance of family structure in improving the overall success of peccary translocations may not outweigh the additional costs of trapping family groups. Thus, soft releases may be a more cost effective measure in establishing peccary populations on target release sites.



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## **APPENDIX A**

### **AN EVALUATION OF EAR TAG RADIO TRANSMITTERS FOR COLLARED PECCARIES**

#### **INTRODUCTION**

Collared peccaries (*Tayassu tajacu*) are small, pig-like mammals native to arid regions of the southwestern United States (Hellgren and Lochmiller 2000). Previous population studies of collared peccaries have used radio transmitters attached via surgical implants (Ilse and Hellgren 1995, Gabor et al. 1997) or traditional neck collars (Schweinsburg 1971, Vieira 1999). The use of traditional neck collars have been problematic due the peccary's basic morphology (i.e., limited neck region, Ilse and Hellgren 1995) and the increased risk of neck collars becoming entangled in dense brush thickets typically used by collared peccaries. Surgical implants of intraperitoneal radio transmitters overcome many of these limitations and are a feasible alternative in telemetry studies of collared peccaries (Ilse and Hellgren 1995, Gabor et al. 1997). However, some disadvantages of radio implants include the need to anesthetize collared peccaries during the surgical procedure (Gabor et al. 1997) that may delay recovery for several hours and ultimately increase risk of capture myopathy (Peterson et al. 2003). This is particularly important in the translocation of collared peccaries where the animal is already under considerable stress (Nielsen 1988). A less invasive and potential alternative to surgical implants may include the use ear tag radio transmitters (Silvy et al. 2005, Fuller et al. 2005). Ear tag transmitters have recently been used in wildlife population studies in that last 10 years (C. Kochanny, Advanced Telemetry Systems,

personal communication), and typically are attached using a modified domestic animal ear tags. For example, ear tag transmitters have been successful in the study of mule deer (*Odocoileus hemionus*) (Garrott et al. 1985), American beaver (*Castor canadensis*) (Rothmeyer et al. 2002), black bear (*Ursus americanus*) (Lee and Vaughan 2004), and grizzly bear (*Ursus arctos*) (Servheen et al. 1981, Garshelis et al. 2005). The effectiveness of ear tag transmitters on collared peccaries or other pig-like mammals, however, have not been evaluated. In my study of translocated collared peccary in the Texas Hill Country, I evaluated a radio transmitter system attached to collared peccaries using 2 double stainless steel studs. Here I report the effectiveness of this ear tag transmitter system on translocated collared peccaries in overcoming some of the previously mentioned limitations.

## **METHODS**

### **Trapping and translocation**

In Fall 2004, Texas Parks and Wildlife Department (TPWD) biologists began efforts to restore collared peccaries into historic ranges. Peccaries were live-trapped in Choke Canyon State Park (CCSP) and on the Chaparral Wildlife Management Area (CWMA) in south Texas. Collared peccaries were trapped using a variety of techniques including corral traps and aluminum box traps (Neal 1959). Upon capture, peccaries were physically restrained using a pole snare. Captured peccaries were loaded into a trailer and transported to the Mason Mountain Wildlife Management Area (MMWMA). Mason Mountain WMA is approximately 2,157 ha, located in the Edwards Plateau

Ecological Region of the Texas Hill Country. Collared peccaries historically occupied the region.

### **Radiotelemetry**

I translocated 29 collared peccaries in 3 treatment groups: (1) intact family group, soft release (GSR, 2 males, 6 females), (2) intact family group, hard release (GHR, 3 males, 4 females), and (3) mixed family group, hard release (MHR, 5 males, 9 females). Translocated peccaries were moved over a 1–3-month period in Fall 2004. For GSR peccaries, animals were held in a 1-ha pen for 10 days. Prior to release into a holding pen (soft release) or into the management area (hard release), a battery-powered mortality-sensitive radio transmitter were attached to each collared peccary (Figure 1, 150-152 MHz, 15-20 g, Advanced Telemetry Systems, Isanti, Minnesota). The ear tag transmitter system consisted of transmitter, 2 stacked batteries (similar to quail [*Colinus* spp.] radios), and 2 stainless steel studs glued to transmitter housing (Figure 1). The double studs were used to prevent the radio transmitter from rotating when installed and minimize risk of transmitter being torn out. The transmitter was attached with a washer and nut with the antenna running along the ridge of peccary's ear (Figure 1). A prefabricated 2 hole punch was used to pre-punch holes in peccary's ear prior to attachment. Following release, radio-tagged peccaries were monitored 2–5 times/week for 6 months via homing and triangulation (White and Garrott 1990). Animals were censored after their last known encounter if radios failed or could not be located (Pollock et al. 1989). Any detected mortality was immediately located, and cause of mortality determined.



### **Data analysis**

I calculated the rate of loss (i.e., change in the number of functioning radios on the study area) by treatment group using simple linear regression for a 6-month period. I compared the number of animals at risk by month using scatter plots (Ott 1993). The slope of each line was calculated to compare the number of radios lost or malfunctions for each treatment group.

### **RESULTS AND DISCUSSION**

The mean number of days for radios functioning before radio failure or censoring by treatment was GSR = 99 (SE = 25, range = 1-175), GHR = 41 (SE = 25, range = 3-138), and MHR = 8 (SE = 1, range = 2-17). The number of censored radios (i.e., left the study site or radio failure) was high ( $n = 26$ ). The rate of loss (number of radios leaving/dying on study area/month) by treatment was lowest for the GSR radios (-0.885) followed by the GHR (-1.257) and MHR (-3.314) radios (Figure 2). Four transmitters dislodged from the ear and were recovered in dense brush suggesting they were caught on vegetation. Two radios were still functioning at the end of the study and 4 radios failed due to battery life or other causes. The remaining radios were censored after their last known encounter on the study site. The peccary's preference for inhabiting dense woody vegetation leads to the possibility of radios getting "caught" and ripping out. Also, when using a small transmitter battery life becomes an issue (Fuller et al. 2005). This technique may have its limitations for a long term study but I believe this is an effective method for short term studies requiring radio-telemetry for collared peccaries.

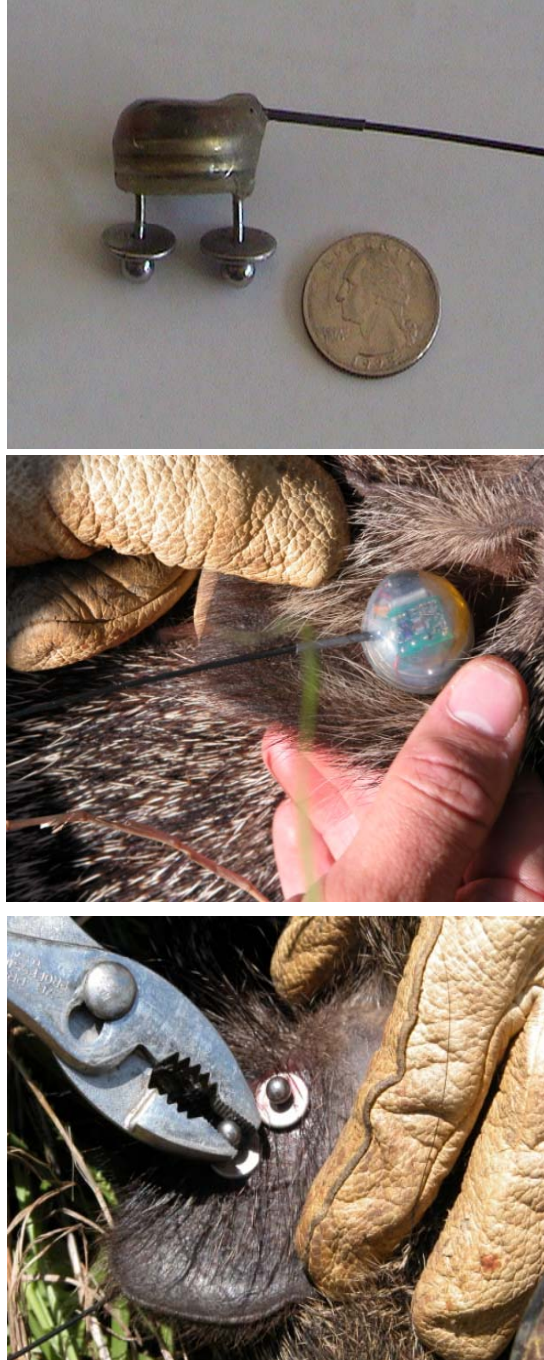


Figure 1. Comparative radio-transmitter size, placement in the peccary's ear and transmitter attachment process for translocated collared peccaries at Mason Mountain Wildlife Management Area, Mason, Texas, 2004.

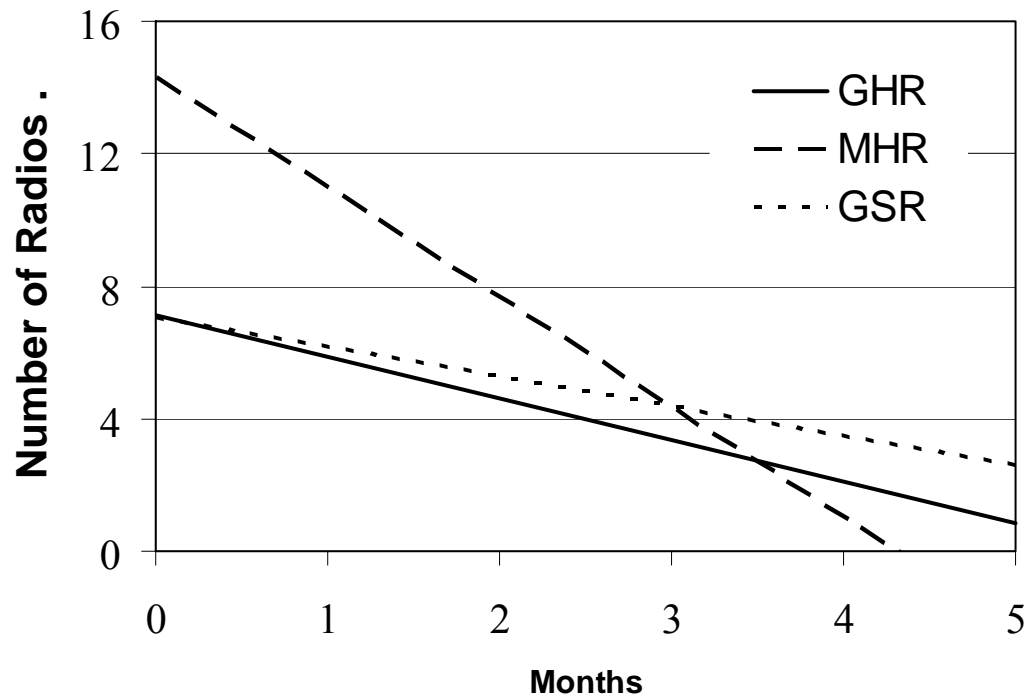


Figure 2. Rate of loss of translocated collared peccary radio-transmitters at Mason Mountain Wildlife Management Area by group and release type (family group/soft release [GSR], family group/hard release [GHR], mixed group/hard release [MHR]), Mason, Texas, March–August 2004.

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### PUBLICATIONS

Peterson, N. M., R. R. Lopez, P. A. Frank, B. A. Porter, and N. J. Silvy. 2004. Key deer fawn response to urbanization: is sustainable development possible? *Wildlife Society Bulletin* 32: 493-499.