BREEDING BIOLOGY OF SUBCUTANEOUS TRANSMITTER IMPLANTED WHITE-WINGED DOVE (*ZENAIDA ASIATICA*) IN KINGSVILLE TEXAS

THESIS

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ABSTRACT

Various types of transmitter attachments have been used to obtain nesting data for birds. Previous studies testing the effectiveness of various attachment devices show that subcutaneous implants did not negatively impact captive nesting doves. Forty-two white-winged doves (*Zenaida asıatıca*) trapped in Kingsville, Texas, were implanted with a transmitter in the field and released following surgery. Doves were checked after 24 h to assess whether surgery caused mortality to the bird. The 24 -h post surgery survival of doves was 97.6%. The 72-h post surgery survival of doves was 95.2%. Average surgery lengths were 8.04 minutes. Doves were tracked using "H" and Yagi style antennas. Of 40 doves with transmitters, 26 nested at least once. Ten birds nested a second time and three individuals nested a third time. Eighty-five percent of nests occurred in live oak (*Quercus fusiformes*) and Rio Grande ash (*Fraxinus berlandieriana*) trees. The overall nest survival rate was 0.53 in 2000. Transmitters began to fail within 50 days of surgery. This field test showed that subcutaneous implants are an effective method for tracking and collecting reproductive and nesting data for white-winged doves.

INTRODUCTION

White-winged doves (*Zenaida asiatica*) of the family Columbidae inhabiting Texas belong to the eastern subspecies *Zenaida asiatica asiatica*. The species can be recognized in the field during flight by a conspicuous, bold, white wing patch flight. Other characteristics of adult eastern white-winged doves include a distally rounded tail, an orange eye with a bare, blue eye-ring, and a prominent black spot below the eye. The breeding range of white-winged doves extends from the southern United States into northeastern Mexico. In winter, white-winged doves migrate to a large geographic area that includes southern Mexico to Costa Rica (Cottam and Trefethen 1968).

Historically, the breeding range for white-winged doves in Texas encompassed the Lower Rio Grande Valley in Starr, Willacy, Cameron, and Hidalgo counties. Cottam and Trefethen (1968) suggested that the native, Tamaulipan brush community characterized by ebony (*Pithecellobium ebano*), huisache (*Acacia farnesiana*), retama (*Parkinsonia aculeata*), and mesquite (*Prosopis glandulosa*) provided optimum habitat for nesting. During the early and mid-1900s, about 95% to 99% of the prime, native nesting habitat for white-winged doves was cleared for agricultural crops (Kiel and Harris 1956, Cottam and Trefethen 1968). As a result, the nesting habitat for *Z. asiatica* shifted to citrus groves that had been planted on these lands during the 1940s. By 1950, Cottam and Trefethen (1968) found 80% of the breeding population nesting in citrus groves.

During the 1900s, the population of white-winged doves declined in the Lower Rio Grande Valley. Several factors caused the decline. Drought during the 1920s contributed to a substantial decrease in white-winged dove populations from the "millions" to 200,000 (Kiel and Harris 1956). Freezes in 1951, 1962, 1983 and 1989 caused severe destruction to citrus groves but little damage to native brush (Cottam and Trefethen 1968, Lonard and Judd 1985, 1991). After the freeze in 1989, only 10% of the breeding white-winged doves in the Lower Rio Grande Valley nested in citrus groves (Waggerman and Lyon 2001). In addition to habitat loss, an increase in the abundance of great-tailed grackles (*Quiscalus mexicanus*) and subsequent predation by these birds on white-winged dove nestlings also contributed to the decline in white-winged doves (Blankinship 1966, Cottam and Trefethen 1968).

As a result of these events, a northern expansion away from the historical breeding range occurred over a 40-year span (Kiel and Harris 1956, Cottam and Trefethen 1968). Previously, populations outside the Lower Rio Grande Valley had been considered negligible (Cottam and Trefethen 1968, George 1991). White-winged doves began to appear in urban habitats of south Texas near the Rio Grande River northward to Alice, Kingsville, San Antonio, Austin, and Waco (George 1991). Breeding populations with survival of young in urban habitats of these northern cities contributed to the range expansion of white-winged doves in Texas. Since 1995, white-winged dove populations north of the Rio Grande Valley have exceeded the population of the Lower Rio Grande Valley. In 2001, these northern populations in urban habitats surpassed 1.7 million birds, with highest densities in Val Verde (110,474), Travis (285,947), and Bexar (1,095,043) counties (Waggerman and Lyon 2001). The Lower Rio Grande Valley population was about 465,000 birds in the same year.

Few studies have explored the breeding biology of white-winged doves in urban habitats (West et al. 1993, Hayslette and Hayslette 1999) because these populations were considered insignificant (Cottam and Trefethen 1968, Oberholser 1974, George 1991).

Small and Waggerman (1999) found a significant increase in breeding by white-winged doves in urban habitats from 1976 to 1997. The increase in breeding and productivity may have resulted from an extension of the breeding season (Hayslette and Hayslette 1999), suitable nesting habitats outside the Lower Rio Grande Valley (West et al. 1993), and close proximity to food and water. Hayslette and Tacha (1996) suggested reduced predation from great-tailed grackles had occurred because of a decrease in flushing tendencies by white-winged doves. This behavior coupled with optimum habitat in urban areas led to an increase in breeding success. The transition from breeding in wild, rural environments to established and expanding populations in urban habitats has been a unique ecological event. Seldom does such a shift in breeding habitat occur in nature where the phenomenon is recognized and can be studied. The study of nesting success by white-winged doves in urban habitats could reveal information on why this species has selected nest sites in urban areas.

It is difficult to radio track and monitor birds in urban settings because of the concentration of many individuals in a small area. In tracking birds, it is important to distinguish individuals and use them as focal subjects in data acquisition. Leg bands have been used for many years for identifying individual birds, but the method fails when dealing with highly mobile species. A method was needed that would allow repeated acquisition of locational and movement data for the same bird.

A new method using surgically implanted radio transmitters in mourning doves (*Zenaida macroura*) and white-winged doves proved successful in laboratory studies (Schulz et al. 1998, 2001; Rosales 2000). I wanted to test the efficacy of this new method for identifying and tracking individual white-winged doves under field conditions. The purpose of my study was to implant white-winged doves with radio transmitters to quantify breeding and productivity of an urban assemblage of white-winged doves in Kingsville, Texas. The objectives of my study were to: (1) test the effectiveness of surgically implanted subcutaneous radio transmitters as a means of identifying individual doves under field conditions, (2) monitor the effects of the surgical procedure on white-winged doves for problem analysis, critique, and future training, (3) monitor survival and determine the cause of mortality of white-winged doves after implant surgery, (4) track each individual to its site source two days/14 days, (5) monitor each nesting dove with an implanted transmitter for nesting status and record nesting data, such as number of eggs per clutch, survival of hatchlings, number of young fledging, nesting success, number of clutches laid, and number of nests used/built during the breeding season, type of tree used, height of tree, and height of nest, for comparisons with previous experiments, (6) record climatological data on temperature, humidity, and general weather conditions, and (7) interpret home range data using minimum convex polygons.

METHODS AND MATERIALS

Study Site

This study was conducted from May thru August 2000 in Kingsville, Kleberg County, Texas. Kingsville has a human population of about 31,000, which mostly reside within the urban confines of the city. Kingsville is located within the Gulf Coast Prairie ecoregion of Texas. Agricultural crops and grassland pastures dominate land use over most of the area. Typical plants associated with surrounding rural areas are whitebrush (*Aloysia gratissima*), desert olive (*Forestiera neomexicana*), retama, Texas pricklypear (*Opuntia lindheimeri*), lotebush (*Zizyphus obtusifolia*), desert yaupon (*Schaefferia cuneifolia*), tasajillo (*Opuntia leptocaulis*), guayacan (*Guaiacum angustifolium*), catclaw (*Acacia greggii*), Hall's panicum (*Panicum hallii*), and purple three-awn (*Aristida purpurea*). The primary study area consisted of urban areas of Kingsville, the campus of Texas A&M University at Kingsville, and secondarily the surrounding croplands. Dominant plants in urban residential areas consisted of mature mesquite, hackberry (*Celtis spp.*), Rio Grande ash, live oak and several species of ornamental shrubs and trees. Average temperature during the study was 32° C with 5-10 cm of rainfall.

The estimated population of white-winged doves in Kingsville was 27,000 (Waggerman and Lyon 2001). The number of doves in the Kingsville area exceeded the minimal level necessary to conduct the experiment. The aggregation of white-winged doves at collection sites was affected by several residents in neighborhoods providing supplemental food and water. Typical predators of the white-winged doves in these urban habitats included great-tailed grackles, green jays (*Cyanocorax yncas*), and domestic cats (*Felis catus*).

Baiting and Trapping

The study began with a reconnaissance of Kingsville to identify areas with a substantial number of doves. Seven bait/trap sites were established by baiting in urban habitats. Bait/trap sites were cleared of vegetation and positioned in the shade to prevent death from heat. Prior to trapping, the seven sites were baited every third day with a mixture of scratch feed and sunflower seeds. These sites were checked regularly every morning and evening for presence of white-winged doves.

Trapping began 19 May 2000 and continued thru 09 June 2000. Four standard wire funnel walk-in traps (92 mm x 60 mm x 15 mm) were used to trap white-winged doves. The four traps were rotated among the seven established trap sites to reduce trapping pressure in an area. Traps were baited every night and checked at 0700 h every morning. Traps were checked every 90 minutes to prevent doves from over-heating. Trapping continued until 1900 h to allow for ample light to conduct surgeries.

Transmitters

Prior to implantation, the signal strength of transmitters (Advanced Telemetry Services, Insanti, Minnesota) was tested by measuring the greatest distance that the signal could be detected along an unobstructed roadway. Transmitters weighed about 3.5 g and had a 12.54 cm antenna. The antenna remained outside the body after surgery. All transmitters operated in the 165 mhz frequency. This frequency was used to avoid interference from other telecommunication sources. The transmitters had an estimated operational time of 120 days and a line-of-sight strength of ≥0.8 km with the omni-directional antenna.

Surgical Procedures

Transmitters were implanted only in adult white-winged doves. Captured doves were handled using procedures in accordance with standard guidelines set by United States Government's Principles for the Utilization and Care of Vertebrate Animals Used in Testing, Research, and Training and approved by the Southwest Texas State University Animal Care and Use Committee (protocol number 5QEKCT_02). Male and female white-winged doves are almost indistinguishable using plumage characteristics. Individuals were sexed using cloacal characteristics following capture and prior to surgery (Miller and Wagner, 1955). Male cloacae possess two conical papillae, while females lack these papillae. United States Fish and Wildlife Service leg bands were placed on birds as an alternate identification method. Twenty-four males and 16 females were implanted with subcutaneous transmitters and monitored for nesting success. All surgeries were performed by Michael F. Small in the field following guidelines established by Schulz et al. (1998, 2001) and Rosales (2000). A wooden box housed the anesthesia machine that was operated out of the back of a pick-up truck. Medical oxygen was supplied to the anesthesia machine. Prior to surgery, all medical instruments and transmitters were placed into a diluted solution of chlorohexidine for sterilization. Once the sex of the bird was determined, anesthesia was given using a concentration of 3.0% isoflurane mixed with oxygen through a cone fitted over the dove's head. Birds were fully anesthetized before initiation of surgery. Contour feathers were removed from the surgical site at the nape of the neck and from the antenna exit point, which was slightly lateral to transmitter placement.

The surgical site was scrubbed using chlorohexidine. A 10 mm incision was made using a scalpel blade. A pocket was formed in the incision for the transmitter using forceps. Using forceps, the transmitter was placed into the subcutaneous pocket. A 16-gauge needle was used to pierce skin providing an exit site for the antenna. The antenna was threaded through the needle. The needle was removed and the antenna was pulled to form a tight fit in the pocket. Two to four drops of the antibiotic Baytril were added to the incision. The incision was closed using gut suture with standard continuous stitches. Surgery times were recorded and monitored for problem analysis, critique, and future training.

After surgery, each bird was placed in a separate holding cage until the effects of anesthesia and surgery had subsided. Before release the transmitter was checked for an appropriate signal. When the bird could walk and flap its wings, it was released. Birds were monitored for survival after the implant surgery. Dead birds were evaluated to determine the cause of mortality.

Data Collection

Tracking

White-winged doves were tracked using omni-directional whip and Yagi type antennas. The omni-directional antenna was placed on the roof of a vehicle to detect signals in an area. The Yagi antenna was used at shorter distances to locate the site location. The site location was the resting or nesting site for a bird. Doves with transmitters were randomly sorted into five groups of eight birds for tracking. Tracking on Day 1 began at 0800 h; Day 2 started at 0900 h, etc. Tracking continued each day through 1700 h. This rotational system kept individual doves from being tracked at the same time during ensuing days. The groups were rotated as follows: Week 1: Groups 1, 2, 3, 4, and 5; Week 2: Groups 2, 3, 4, 5, and 1; Week 3: Groups 3, 4, 5, 1, and 2; Week 4: Groups 4, 5, 1, 2, and 3; Week 5: Groups 5, 1, 2, 3, and 4.

This rotational pattern allowed random collection of data on diurnal activity for each dove. Each group was given three hours of searching time during a normal rotation. If a dove was not found during the initial rotational time, an extra hour of searching was performed immediately. If the bird was still missing, an extra hour of night searching was performed. After three extra days of searching, the dove was considered lost and removed from the rotation. I continued to search for the dove only at night. Each dove was tracked to its source two times every 14 days. GPS points were taken each time a dove was located.

Nest Monitoring

Nests were monitored once every four days. Adult birds occasionally were flushed from the nest to check the nesting status. Nesting doves were monitored for breeding success using a standard mirror on pole device (Parker 1972). If the dove did not flush, it was assumed that it still had an active nest and was checked at a later time. The species of tree in which a nest occurred was recorded. A standard clinometer was used to obtain the heights of nests and trees. Temperature, humidity, and general weather conditions also were recorded. After fledglings left a nest, the nest was monitored for another nesting event by the same dove or a dove without an implanted transmitter.

Data Analysis

GPS points were taken each time a dove was located for individual home range analysis. A minimum of five points per dove was necessary for home range calculation. I used Arcview (Version 3.2) to prepare minimum convex polygons and to calculate home range size for each dove. I used unpaired t-tests to test for differences in home range size of males and females with minimum observation points of 5 and 10.

The Mayfield method (Mayfield 1961, 1975) was used to evaluate nesting success based on days of exposure. By this method, a nest is successful if at least one young fledges from the nest. Exposure is considered the number of days the nest was observed (Mayfield 1975). Nesting success was calculated based on an incubation period of 14 days and a nestling period of 10 days. To calculate nesting success when all nestlings in a nest were lost, I assumed the nestlings survived to the midpoint of the last two observations (Mayfield 1975). Overall heights of trees were separated into two parts, low (0-50%) and high (51-100%). Nests were placed in these categories based on nest location in a tree. I used Chi-square tests to test for differences in nest location in species of tree, and height of a nest in trees.

RESULTS

Surgeries

Twenty-six males and 14 females were surgically implanted with transmitters in the field. The average time for the surgical procedure was 8.04 minutes (SE = 0.42 minutes, and ranging between 4.88 - 15.45 minutes). Two surgeries were repeated due to mortality of doves. One individual succumbed from the effects of anesthesia, and another dove was killed by a predator 48 h after surgery. The expected survival rate for this invasive procedure is 75 % during the first 24 h. The survival rate after the first 24 h was 97.6 % (41/42), which exceeded the expected rate of mortality ($X^2 = 11.5$, df = 1, $p < 0.001$). A survival rate of 95.2% (40/42) for the first 72 h also exceeded the 75 % expected survival rate ($X^2 = 9.17$, df = 1, $p < 0.001$).

Home Range Analysis

Thirty-eight white-winged doves had a sufficient number of site locations to calculate a home range size. Home range sizes for each dove were generated using both five and 10 site locations (Table 1). The home range size of males and females did not differ if either five or 10 locations were used in the analysis ($t = 1.114$, df = 36, $p = 0.27$; $t = 0.374$, df = 27, $p = 0.711$, respectively). Home ranges for males and females showed considerable overlap (Figs. 1,2). Home range maps for each dove are shown in Appendix A.

Nesting

Nineteen males and seven females with transmitters made at least one nesting attempt in 2000 (Table 2). There were no cases of implanted doves forming a pair bond with another implanted dove. Of the 10 renesting events, only one was a female, and no females attempted a third nesting effort. White-winged doves nested in three tree species; Rio Grande ash, live oak, and hackberry. White-winged doves with radio transmitter implants used live oak trees more frequently as nesting sites ($X^2 = 7.46$, $df = 2$, $p < 0.025$). The percentage of nest height to tree height was 68 %in live oaks, 64 % in Rio Grande ash, and 65 % in hackberry. Ninety-two percent (24/26) of white-winged doves nested in the upper portion of trees ($X^2 = 18.62$, $df = 1$, $p < 0.001$) at about the same height (Table 3).

Table 1. The mean home range size (ha) and standard error (SE) for white-winged doves during breeding season in Kingsville, Texas, 2000.

Sex[a]	n	Home Range[b]	SE	Range
Males (5)	24	29.66	10.42	0.07-191.77
Males (10)	22	29.78	11.27	0.07-191.77
Females (5)	14	13.82	4.95	0.02-70.35
Females (10)	7	22.01	8.73	4.42-70.35

[a] Minimum number of observations in parenthesis
[b] Mean home ranges

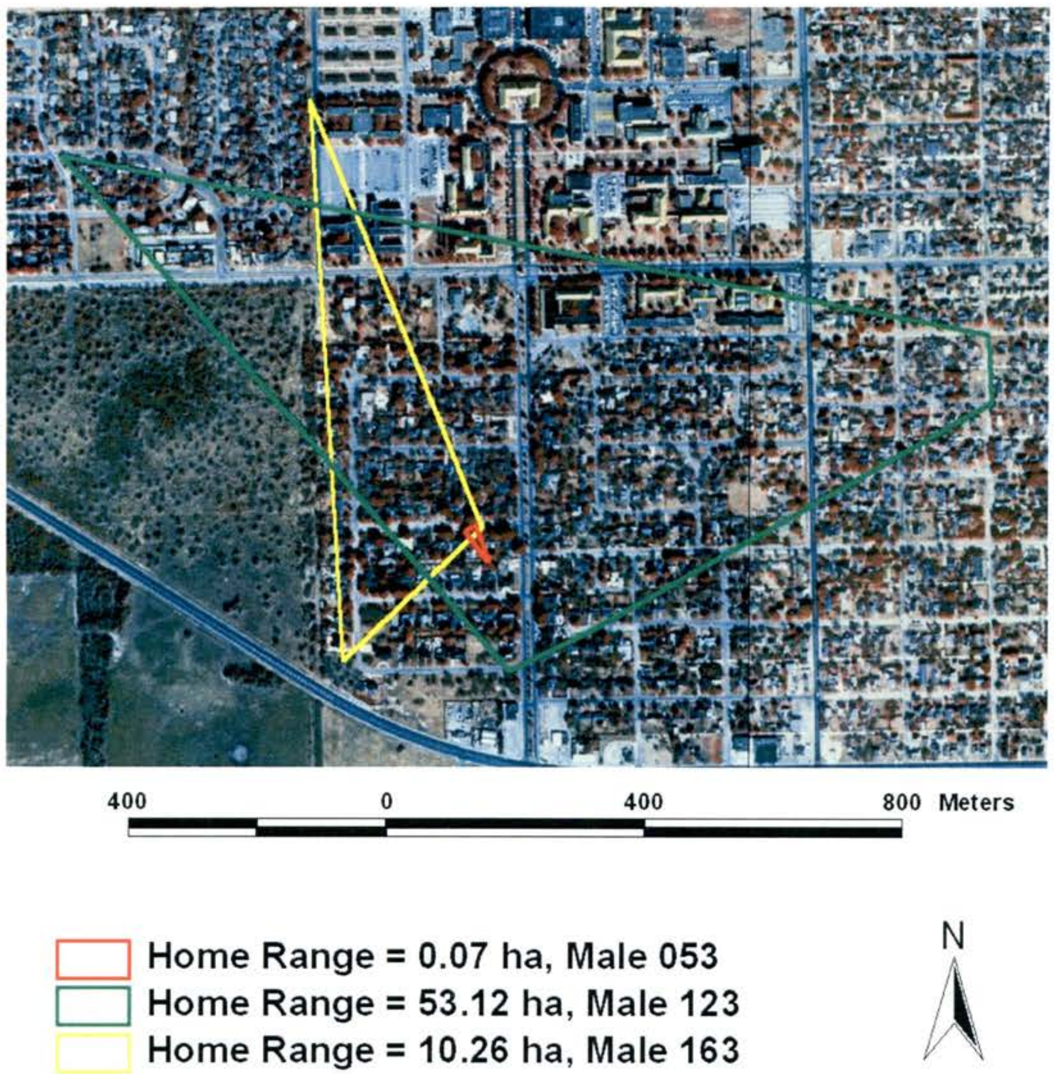

Figure 1. Summer home ranges of three male white-winged doves in Kingsville, Texas, 2000. The minimum convex polygon method was used to calculate home range size.

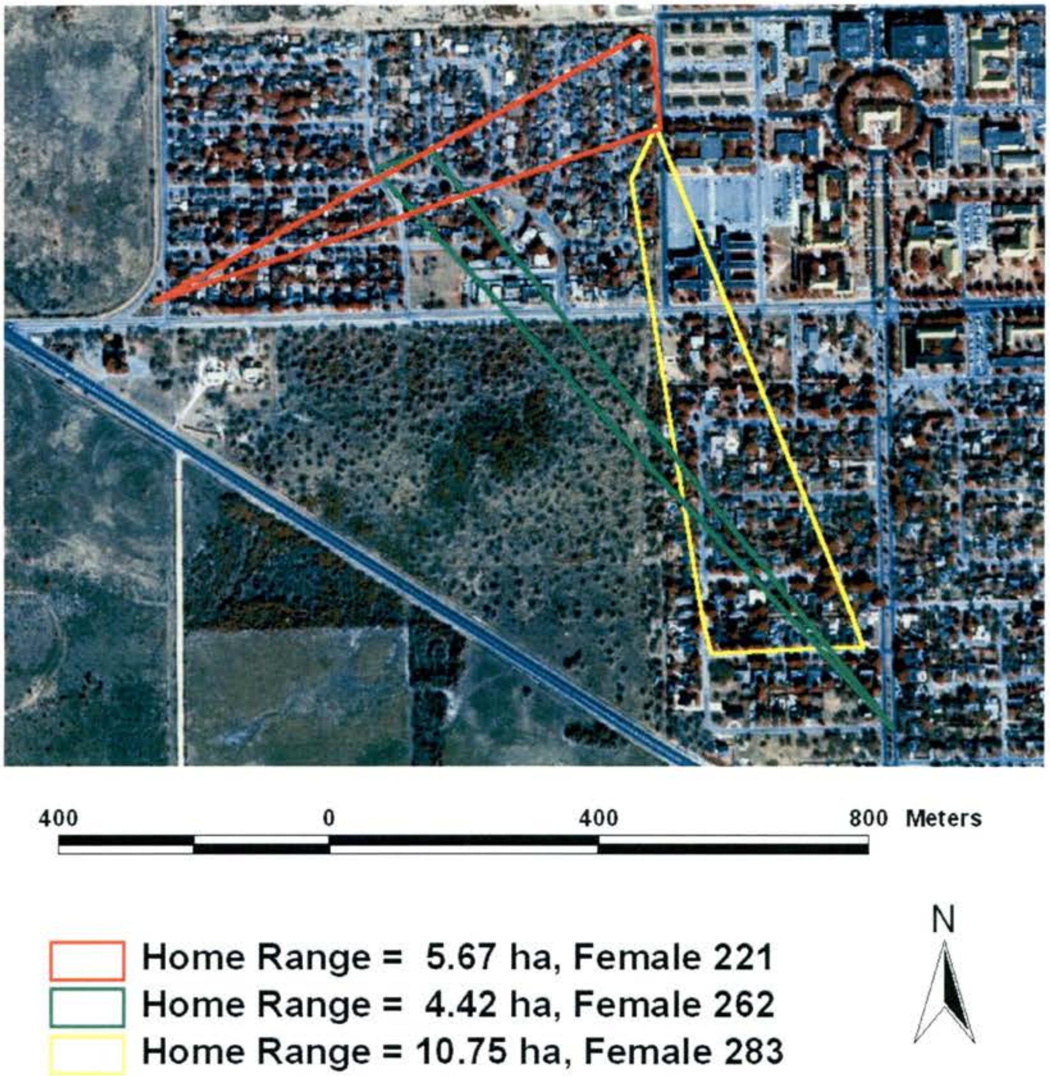

Figure 2. Summer home ranges of three female white-winged doves in Kingsville, Texas, 2000. The minimum convex polygon method was used to calculate home range size.

Table 2. The number of attempted nesting events by white-winged doves with implanted radio transmitters at Kingsville, Texas, 2000. A comparison of the proportion with implanted radio transmitters nesting to all doves with implanted transmitters and confidence intervals for each group are given.

Nest Attempts	n	p^a	95 % CI
1	26	0.65	0.502 - 0.798
2	10	0.39	0.202 - 0.578
3	3	0.30	0.008 - 0.592

[a] Proportion nesting

Nesting Success

The nesting success of a first nesting attempt was 0.95. Success for second nesting attempt was 0.13, and success for a third nesting attempt was 0.02. The estimation of nesting success for all nests of white-winged doves with radio transmitter implants in 2000 was 0.53. Six nests were lost during the egg stage and three nests were lost during the nestling stage.

Doves did not renest in the same nest. Thirty-nine previously used nests were checked often and only one of those nests was used by a dove without a transmitter implant. Three doves renested in the same tree used for the first nesting attempt.

Transmitters

The mean signal distance for transmitters measured by line of sight on an unobstructed road was 0.521km (SE = 0.009 km) using the omni-directional whip antenna. Transmitters had an operational life of 120 days. In residential areas the distance and strength of the signal was considerably less. Transmitter failure was noted by squealing noises by the 50th day and at least six transmitters failed by the 70th day. Several causes for the loss of doves for tracking include mortality, predation, transmitter failure, and migration (Fig. 3). Transmitters were located from doves that had succumbed to predation.

Table 3. The mean height of nests of white-winged doves and mean height of tree species in Kingsville, Texas, 2000.

Tree Species	n	Nest height	SE	Range	Tree height	SE	Range
Live oak	21	7.66	0.50	4.50 - 12.82	11.35	0.51	6.39 - 14.90
Rio Grande ash	12	6.89	0.46	4.86 - 9.83	10.83	0.34	7.58 - 11.94
Hackberry	6	7.69	0.71	5.64 - 9.95	11.93	0.54	10.03 - 13.42

Mortality

Four white-winged doves with implanted transmitters died during 2000. In all cases, evidence indicated the cause of mortality was predation. Two individuals were confirmed cat kills by the owners of the cats. Prior to surgery, five doves were killed by a cat, which had gotten inside of a trap. The cat escaped from the trap when approached.

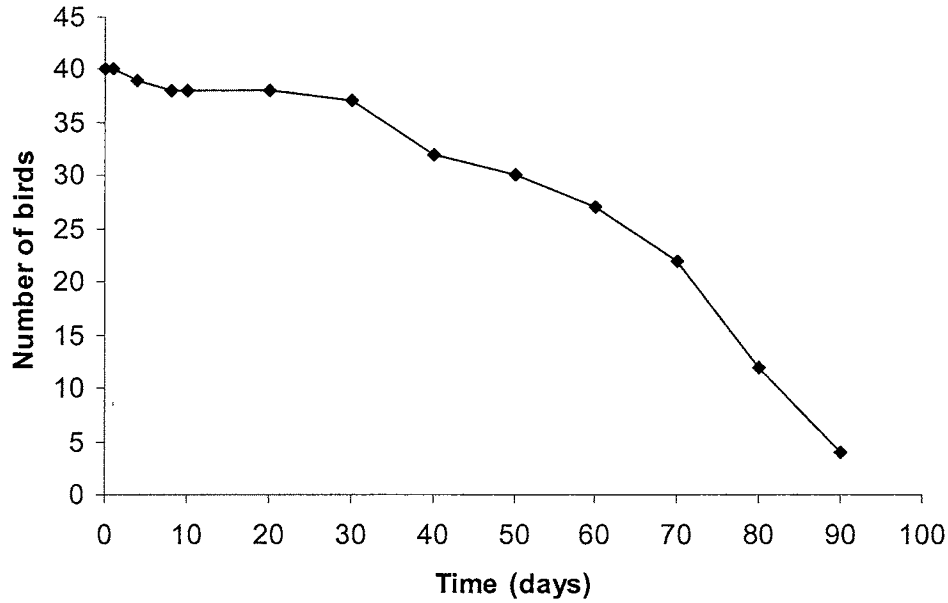

Figure 3. Loss of function for transmitters through time because of predation, mechanical failure, and migration for white-winged doves with surgically implanted transmitters at Kingsville, Texas, May to August 2000.

DISCUSSION

Justification of Transmitter Attachment Technique

Various techniques have been used to attach radio transmitters to birds. Tail mounted transmitters; backpacks, glue-based, harnesses, and collars are some of these techniques. Ramakka (1972) concluded that harnesses reduced courtship activities and caused atypical breeding behaviors in the American woodcock (*Scolopax minor*). Harnesses caused a reduction in clutch number and egg size in mallards (*Anas platyrhnchos*) (Pietz et al. 1993), decreased nesting attempts and number of fledged young in spotted owls (*Strix occidentalis*) (Paton et al. 1991), and lowered survivorship of brants (*Branta bernicla*) (Ward and Flint 1995) and sharp-tailed grouse (*Tympanuchus phasianellus*) (Marks and Marks 1987). Gessaman and Nagy (1988) found a decrease in flight speed and an increase in CO_2 levels in homing pigeons (*Columba livia*) fitted with a harness. Houston and Greenwood (1993) and Rotella et al. (1993) discovered low retention rates of suture-attached transmitters in mallards.

Schulz et al. (1998 and 2001) and Rosales (2000) have shown that subcutaneous implantation of transmitters is an effective method for attaching transmitters to doves. Schulz et al. (2001) found that subcutaneous implants had higher retention rates than glue attachments and lower pathological effects than harnesses. These experiments successfully proved in the laboratory that subcutaneous implantation of radio transmitters had the greatest efficacy for transmitter attachment without causing serious health problems and increased mortality. A field test was needed to assess survival for birds released in the wild immediately following surgical implantation of a transmitter.

Information also was needed to determine whether subcutaneous implants would influence the breeding biology of white-winged doves.

Surgery

Forty-two surgeries were performed in the field. The average time for surgery was 8.04 minutes (SE = 0.42 minutes) with a range of 4.88 -15.45 minutes. These times were similar to mean times performed by Schulz et al. (2001) (8.33 minutes, SE = 0.29, ranging from 5.09 - 13.22 minutes). However, my times were longer than the mean time reported by Schulz et al. (1998) (4.36 minutes, SE = 0.12, ranging from 3.17 - 6.08 minutes).

Recommendations to improve field surgeries include lamps for additional light, and a shield to block wind, which made suturing a problem and increased surgery times. All efforts should be made to maintain a sterile surgical area, which is more difficult in the field. Suitable training will help solve surgical problems more readily.

In this study the problems that were associated with surgeries did not affect the positive outcome of the surgery. Field implantation of transmitters did not substantially increase surgery length or increase mortality. The portable surgical station is an effective way to perform surgeries in the field. Subcutaneous transmitter implants are a viable field technique for equipping doves with transmitters.

Transmitter Performance

Transmitters did not perform as well as expected. Transmitters were expected to have a line-of-sight signal strength of ≥0.8 km and a life of 120 days. The transmitter signals carried shorter distances (0.521 km, SE = 0.009 km) than expected in line-of-sight tests. Once implanted, the transmitter's signal strength was reduced even more.

Transmitters began to fail by day 50 as indicated by a high-pitched squeal. In a few cases, doves were identified by leg bands and transmitter failure was noted by loss of signal. Schulz et al. (1998) found that 50% of subcutaneously implanted transmitters failed by four weeks, and at 10 weeks all transmitters had failed. The transmitters used by Schulz et al. (1998) weighed ≤3.2 g. Our study and Schulz et al. (2001) used transmitters weighing 3.5 g. Extra potting around the battery provided additional protection against body fluids penetrating and shorting out the circuitry. In future experiments, researchers will need to work with telemetry engineers to develop a stronger battery. A stronger battery is needed to increase the signal range without increasing the overall weight and size of transmitters

Home Range

Home range is defined as an area over which an animal travels during normal daily activities (Pianka 1994). Factors that contribute to an individual's home range size include water, food, and seasonal trends (Baekken et al. 1987). Several home range studies have been conducted using birds as the research subjects (Mellen et al. 1992, Burger et al. 1991). Home range estimates in this study were created using the minimum convex polygon (mcp) method, a non-statistical method for calculating home range. Swihart and Slade (1985) suggested the use of mcp in short studies when autocorrelation (not independent) can not be avoided. The major drawback of using mcp in home range analysis are outliers. An outlier can cause an over-estimation of home range size calculated by mcp.

Home range size is expected to increase with every new observation until an asymptote is reached. Rose (1982) showed that to be near 100 observations. Male (n =

5, 29.66 ± 10.42 ha; n = 10, 29.78 ± 11.27 ha) and female (n = 5, 13.82 ± 4.95 ha; n = 10, 22.01 ± 8.73 ha) average home range size increased with number of observations. My data were sufficient to estimate home range of white-winged doves during the breeding season. The rotation for collecting home range data points lowered the effect of autocorrelation. Strength of the transmitter signals may have affected the study by causing an under-estimation of home range. Some doves were found only at night even though the study area was searched thoroughly during the day. Croplands 10 to 20 miles from study site also were searched though no doves with transmitters were found. Cottam and Trefethen (1968) noted nesting sites might be 25 miles from food and water. However in my study, food and water were supplied by many homeowners. Increased power of transmitter signals will increase the accuracy of home range size for white-winged doves in urban settings.

Nesting Data

The probability of nest success for a white-winged dove during the breeding season in Kingsville, TX, in 2000, was 0.53. This value included all initial nesting and re-nesting attempts of doves with transmitters. This value was similar to a nesting success of 0.575 in an urban study in Kingsville (Hayslette and Hayslette 1999). West et al. (1993) found a range of nesting success of 0.39 to 0.73 in urban habitats in San Antonio, Texas. The initial 26 nesting attempts in this study showed an exceptionally high success rate of 0.95. Closeness to food and water, fewer predators, and extended breeding season could be factors in such a high success rate (Hayslette and Hayslette 1999).

Ten (39%) of the nesting doves renested and three (30%) of those doves renested a third time. Nesting success of renesting white-winged doves was 0.13 and 0.02 for doves attempting a third nest. Alamia (1970) observed five doves renesting in the Lower Rio Grande Valley. All were unsuccessful. Swanson (1989) had two cases of renesting, with one failed attempt. Williams (1971) found 13 doves renesting during his study. Cottam and Trefethen (1968) and Kiel and Harris (1956) concluded that white-winged doves produce one to two broods per season. In all cases, doves with transmitters did not utilize old nest or nests of other species. Cottam and Trefethen (1968) and Swanson (1989) found that white-winged doves commonly used the nest of other birds especially great-tailed grackles. Alamia (1970) found that three out of five renesting attempts were in the same nest. It is common for a dove to use the same nest if the clutch is lost early in egg incubation (Cottam and Trefethen 1968).

White-winged doves frequently nested in live oak, hackberry, and Rio Grande ash trees. Hayslette and Hayslette (1999) and West et al. (1993) found live oaks were a common nesting tree for white-winged doves in urban habitats. Cottam and Trefethen (1968) also found live oak and hackberry trees were important nesting trees in urban habitats.

Future Experiments

The phenomenon of the population "explosion" and expansion of white-winged doves into urban habitats is already known. Future research should be conducted around individual birds; number of clutches, success, home range, availability and quality of nesting habitats. Telemetry experiments similar to this one should be conducted. Home range experiments should be conducted in native brush of the Rio Grande Valley for comparisons with urban home ranges. Year-round nesting by doves should be monitored. Experiments should include already existing pair bonded doves to determine number of broods per season.

Literature Cited

Alamia, L. 1970. Renesting activity and breeding biology of the white-winged dove (*Zenaida asiatica*) in the lower Rio Grande valley of Texas. M.S. Thesis. Texas A&M University, College Station, Texas. 125 pp.

Baekken, B. T., J. D. Nybo, and G.A. Sonerod. 1987. Home range size hawk owls – dependence on calculation method, number of tracking days and number of plotted perchings. U.S. Forest Service General Technical. Report RM No. 142:145-148.

Blankinship, D. R. 1966. The relationship of white-winged dove production to control of great-tailed grackles in the lower Rio Grande valley of Texas. Transactions of the North American Wildlife and Natural Resources Conference 31:45-58.

Burger, L. W., M. R. Ryan, D. P. Jones and A. P. Wywialowski. 1991. Radio transmitters bias estimation of movements and survival. Journal of Wildlife Management 55:693-697.

Cottam, C., and J. B. Trefethen. 1968. Whitewings: the life history, status, and management of the white-winged dove. D. Van Nostrand Co., Inc., Princeton, New Jersey. 348 pp.

George, R. R. 1991. The adaptable whitewing. Texas Parks and Wildlife 49:11-15.

Gessaman, J. A., and K. A. Nagy. 1988. Transmitter loads affect the flight speed and metabolism of homing pigeons. The Condor 90:662-668.

Hayslette, S. E., and T. C. Tacha. 1996. Changes in white-winged dove reproduction in southern Texas, 1954-93. Journal of Wildlife Management 60:298-301.

Hayslette, S. E., and B. A. Hayslette. 1999. Late and early season reproduction of urban white-winged doves in southern Texas. Texas Journal of Science 51:173-180.

Houston, R. A., and R. J. Greenwood. 1993. Effects of radio transmitters on nesting captive mallards. Journal of Wildlife Management 57:703-709.

Kiel, W. H., and J. T. Harris. 1956. Status of the white-winged dove in Texas. Transactions of the North American Wildlife and Natural Resources Conference 21:376-389.

Lonard, R. I., and F. W. Judd. 1985. Effects of a severe freeze on native woody plants in the lower Rio Grande Valley, Texas. The Southwestern Naturalist 30:397-403.

Lonard, R. I., and F. W. Judd. 1991. Comparison of the effects of the severe freezes of 1983 and 1989 on the native woody plants in the lower Rio Grande Valley, Texas. The Southwestern Naturalist 36:213-217.

Marks, J. S., and V. S. Marks. 1987. Influence of radio collars on survival of sharp-tailed grouse. Journal of Wildlife Management 51:468-471.

Mayfield, H. F. 1961. Nesting success calculated from exposure. The Wilson Bulletin 73:255-261.

Mayfield, H. F. 1975. Suggestions for calculating nest success. The Wilson Bulletin 87:456-466.

Mellen, T. K., E. C. Meslow, and R. W. Mannan. 1992. Summertime home range and habitat use of pileated woodpeckers in western Oregon. Journal of Wildlife Management 56:96-103.

Miller, W. J., and F. H. Wagner. 1955. Sexing mature Columbiformes by cloacal characteristics. Auk 72:279-285.

Oberholser, H. C. 1974. The bird life of Texas. University of Texas Press, Austin. Texas 1,069 pp.

Parker, J. W. 1972. A mirror and pole device for examining high nests. Bird-Banding 43:216-218.

Paton, P. W. C., C. J. Zabel, D. L. Neal, G. N. Steger, and N. G. Tilghman. 1991. Effects of radio tags on spotted owls. Journal of Wildlife Management 55:617-622.

Pianka, E. R. 1994. Evolutionary Ecology. Harper Collins College Publishers, New York, New York. 486 pp.

Pietz, P. J., G. L. Krapu, R. J. Greenwood, and J. T. Lokemon. 1993. Effects of harness transmitters on behavior and reproduction of wild mallards. Journal of Wildlife Management 57:696-703.

Ramakka, J. M. 1972. Effects of radio-tagging on breeding behavior of male woodcock. Journal of Wildlife Management 36:1309-1312.

Rosales, R. 2000. Effects of transmitter attachment techniques on captive white-winged doves (*Zenaida asiatica*). M.S. Thesis. Sul Ross State University, Alpine, Texas. 68 pp.

Rose, B. 1982. Lizard home ranges: methodology and functions. Journal of Herpetology 16:253-269.

Rotella, J. J., D. W. Howerter, T. P. Sankowski, and J. H. Devries. 1993. Nesting effort by wild mallards with 3 types of radio transmitters. Journal of Wildlife Management 57:690-695.

Schulz, J. H., A. J. Bermudez, J. L. Tomlinson, J. D. Firman, and Z. He. 1998. Effects of implanted radiotransmitters on captive mourning doves. Journal of Wildlife Management 62:1451-1460.

Schulz, J. H., A. J. Bermudez, J. D. Firman, and Z. He. 2001. Comparison of radiotransmitter attachment techniques using captive mourning dove. Wildlife Society Bulletin 29:771-782.

Small, M. F., and G. L. Waggerman. 1999. Geographic redistribution of breeding white-winged doves in the Lower Rio Grande Valley of Texas: 1976-1997. Texas Journal of Science 51:15-19.

Swanson, D. A. 1989. Breeding biology of the white-winged dove (*Zenaida asiatica*) in south Texas. M.S. Thesis. Texas A&I University, Kingsville, Texas. 122 pp.

Swihart, R. K., and N. A. Slade. 1985. Influence of sampling interval on estimates of home-range size. Journal of Wildlife Management 49:1019-1025.

Waggerman, G. L., and C. L. Lyon. 2001. White-winged dove and white-tipped dove density, distribution, and harvest. Performance Report, Federal Aid Project W-128-R-9, Job 2. Texas Parks Wildlife Department, Austin, Texas. 20 pp.

Ward, D. H., and P. L. Flint. 1995. Effects of harness-attached transmitters on premigration and reproduction of brant. Journal of Wildlife Management 59:39-46.

West, L. M., L. M. Smith, R. S. Lutz, and R. R. George. 1993. Ecology of urban white-winged doves. Transactions of the North America Wildlife and Natural Resource Conference 58:70-77.

Williams, Louis. 1971. A renesting study of the white-winged dove (*Zenaida asiatica*) in the lower Rio Grande valley of Texas. M.S. Thesis, Texas A&I University, Kingsville. 82 pp.

APPENDIX A

Figure 4. Minimum convex polygons for males 053, 123, 163 in Kingsville, Texas, 2000.

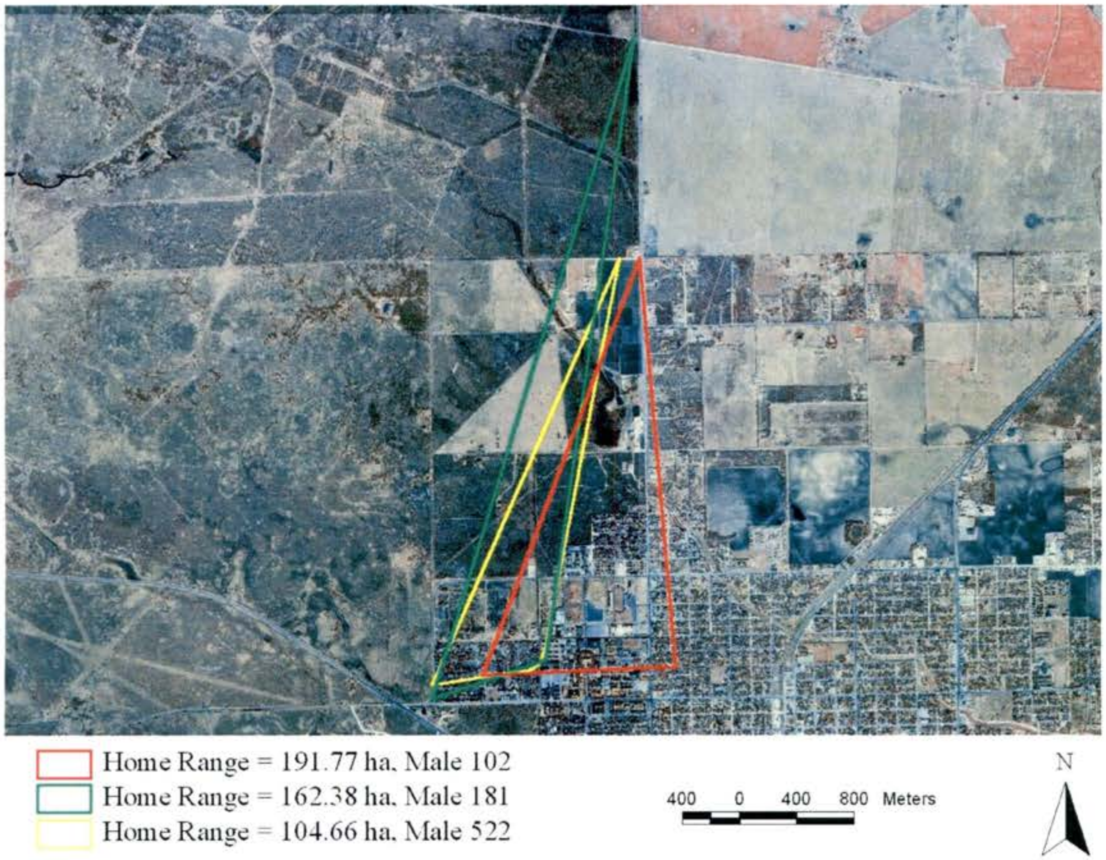

Figure 5. Minimum convex polygons for males 102, 181, 522 in Kingsville, Texas, 2000.

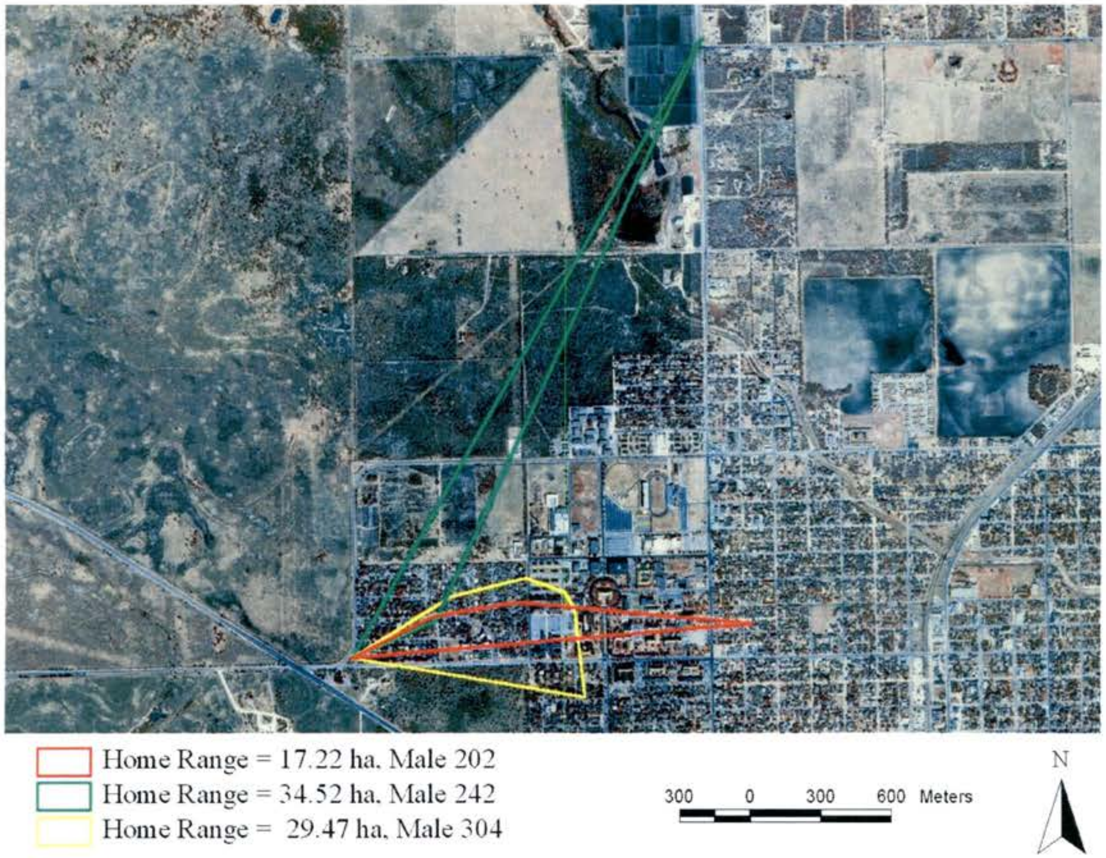

Figure 6. Minimum convex polygons for males 202, 242, 304 in Kingsville, Texas, 2000.

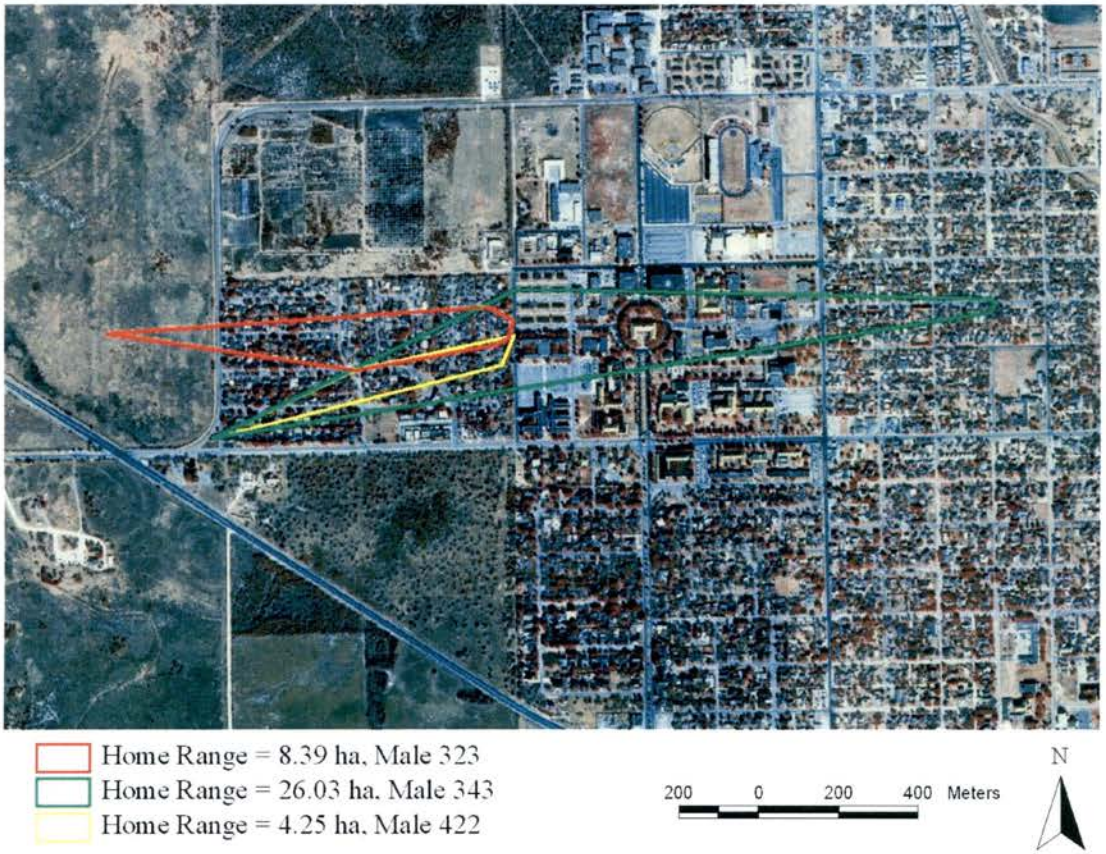

Figure 7. Minimum convex polygons for males 323, 343, 422 in Kingsville, Texas, 2000.

Figure 8. Minimum convex polygons for males 443, 462, 483 in Kingsville, Texas, 2000.

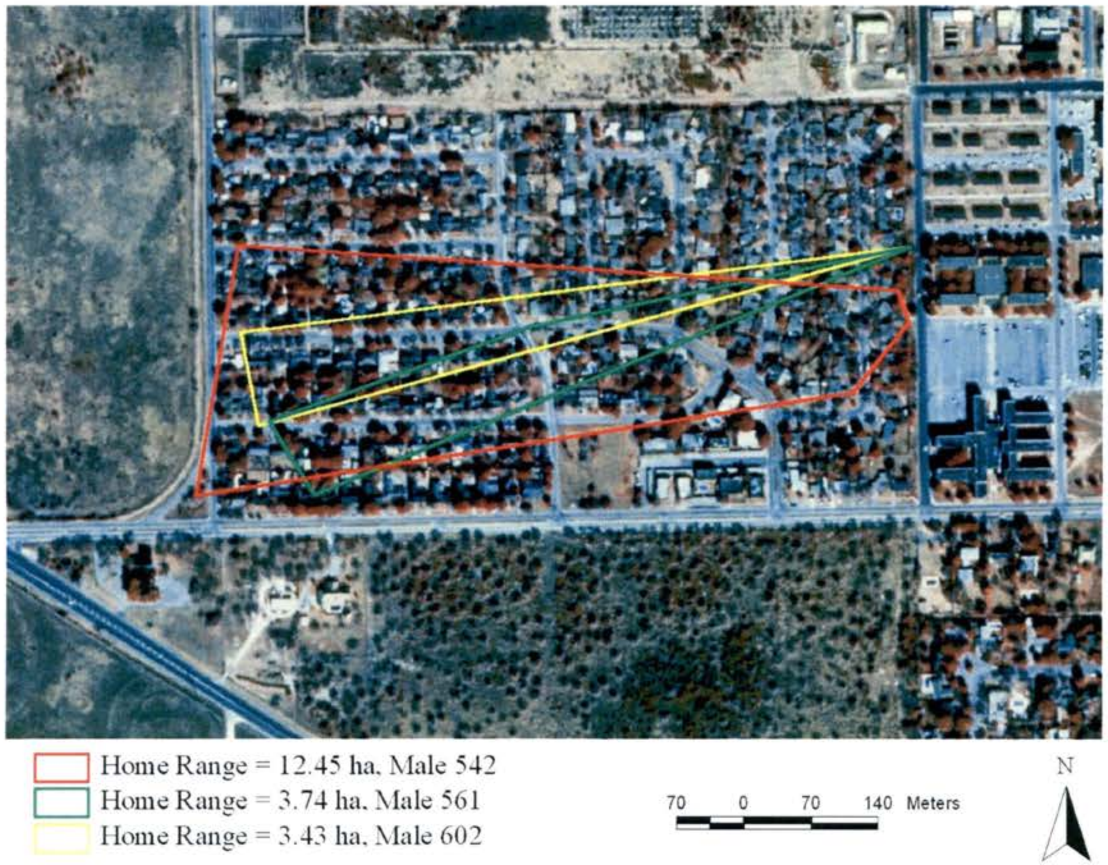

Figure 9. Minimum convex polygons for males 542, 561, 602 in Kingsville, Texas, 2000.

Figure 10. Minimum convex polygons for males 642, 662, 682 in Kingsville, Texas, 2000.

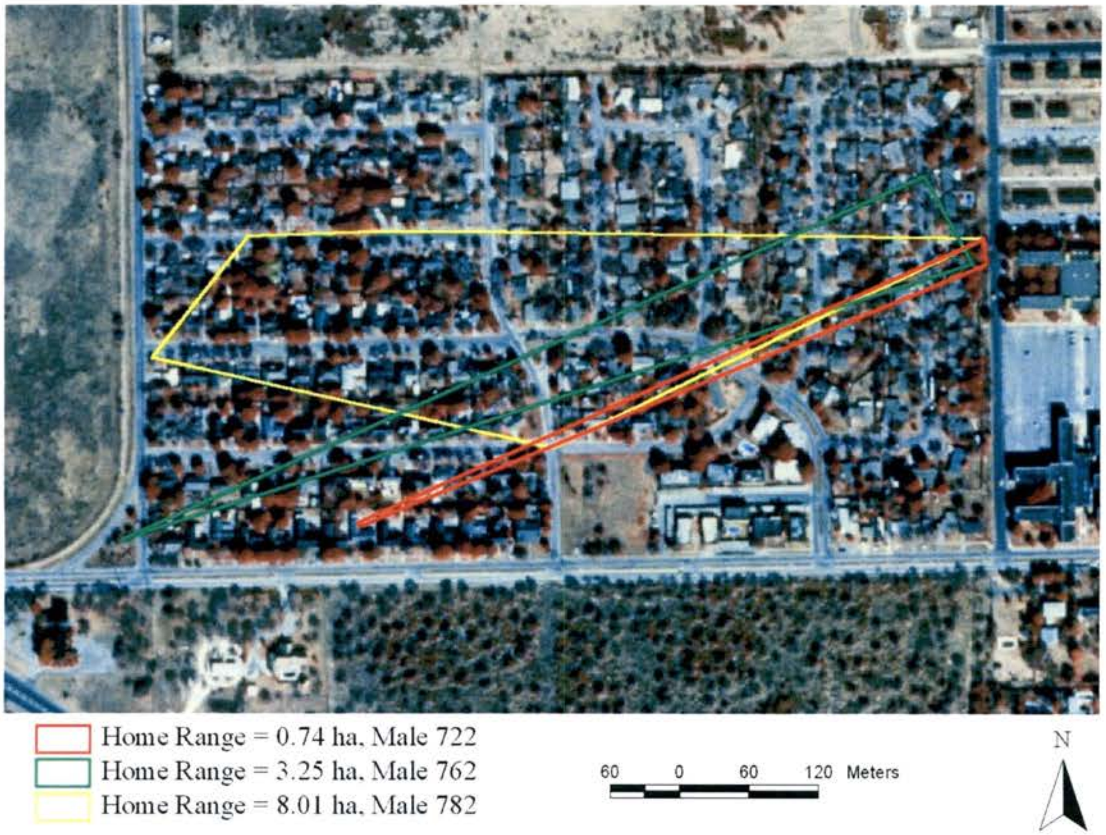

Figure 11. Minimum convex polygons for males 722, 762, 782 in Kingsville, Texas, 2000.

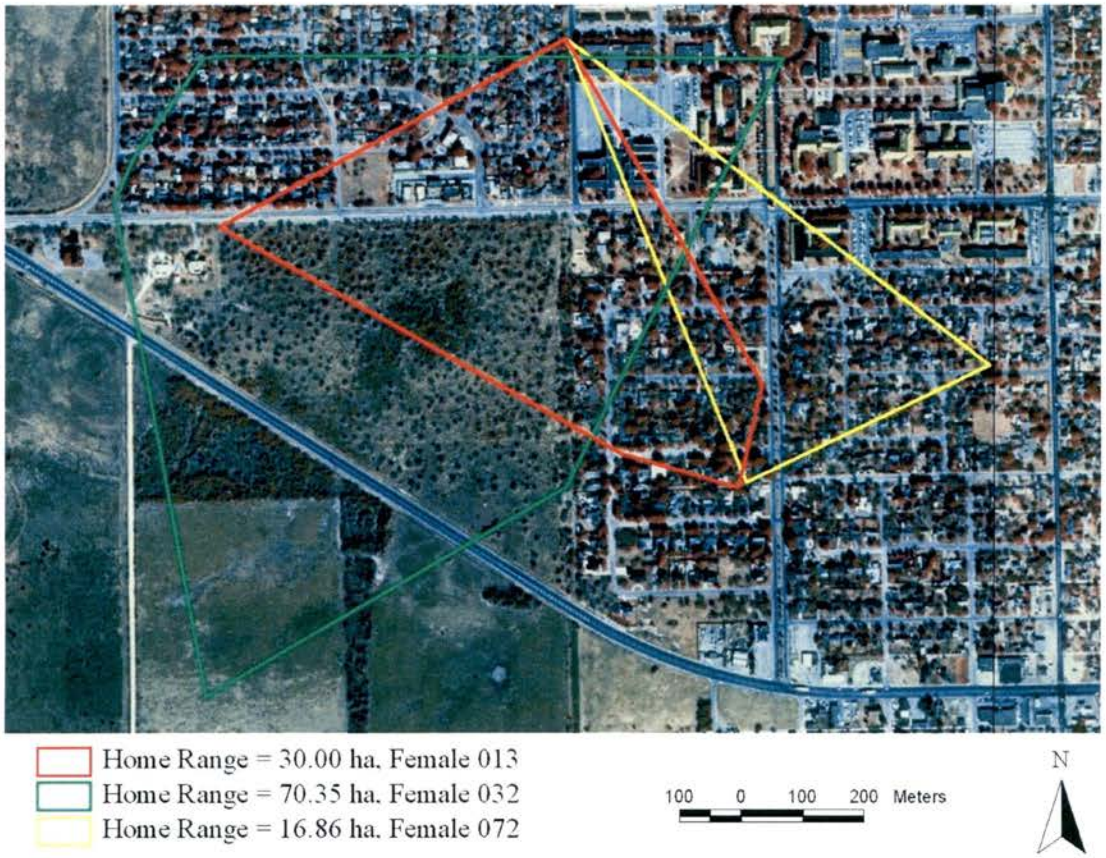

Figure 12. Minimum convex polygons for females 013, 032, 072 in Kingsville, Texas, 2000.

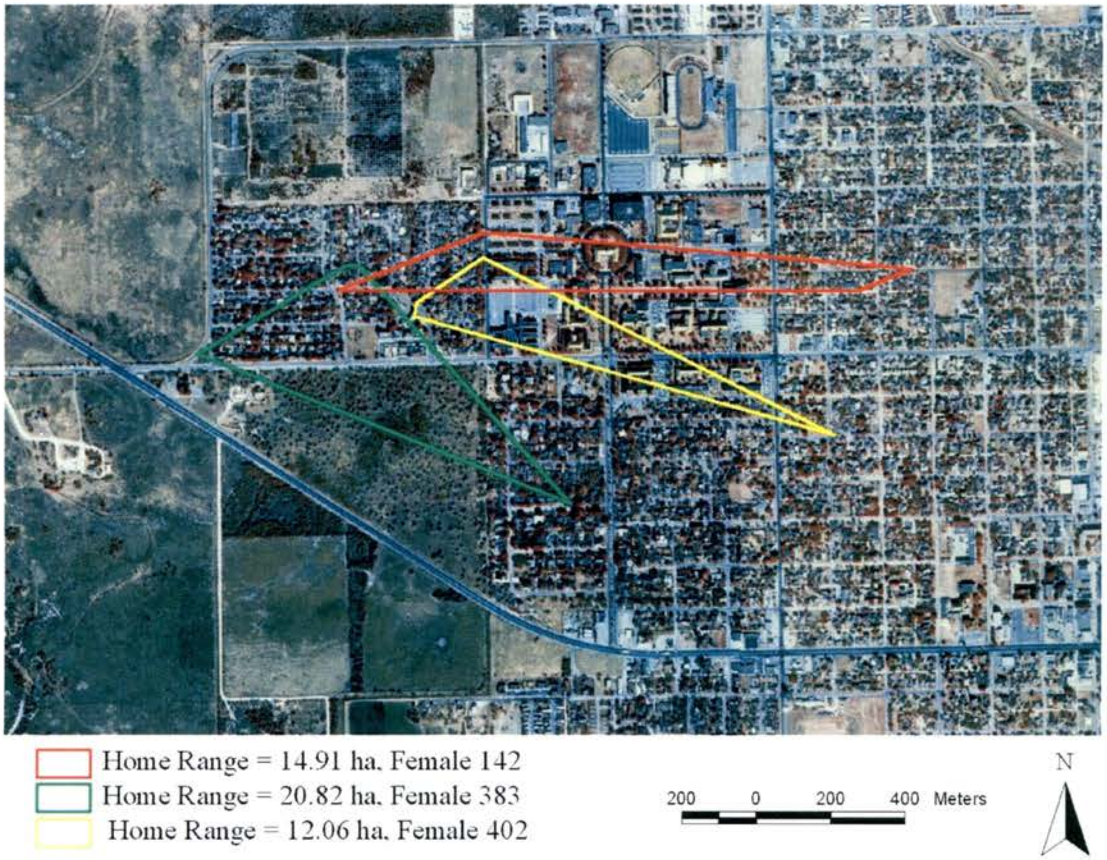

Figure 13. Minimum convex polygons for females 142, 383, 402 in Kingsville, Texas, 2000.

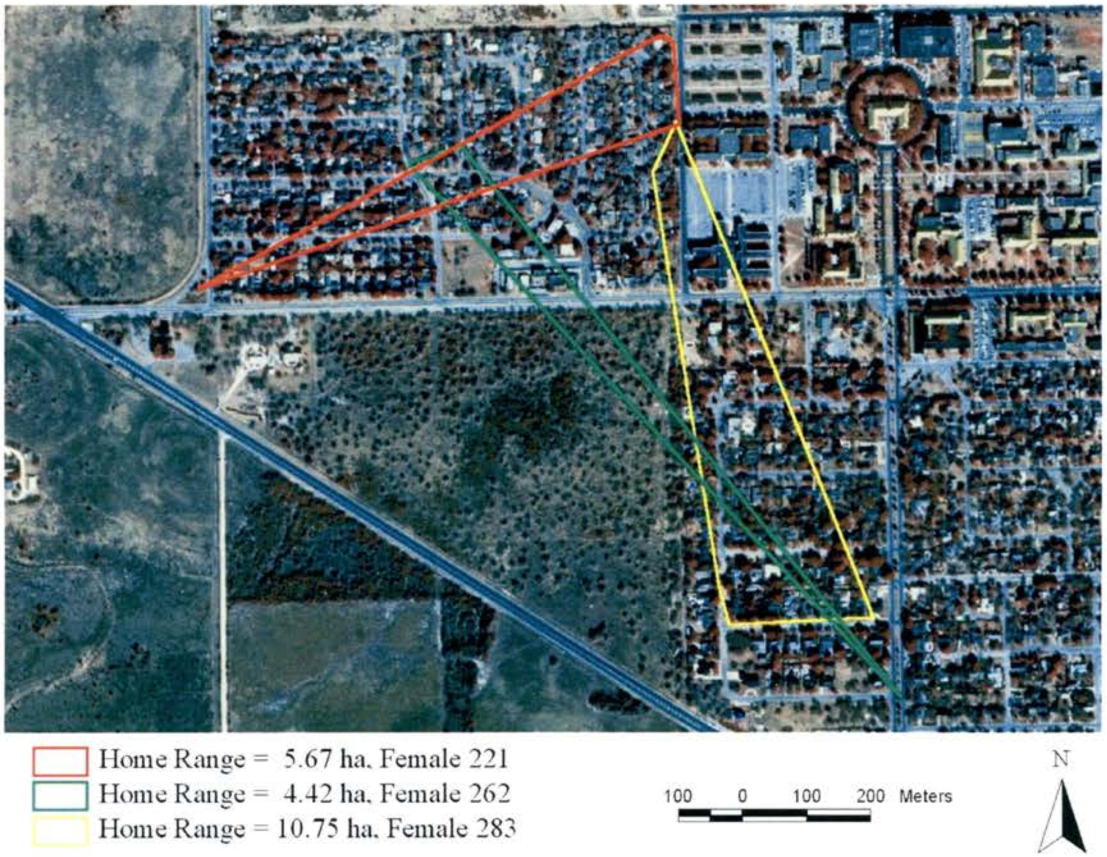

Figure 14. Minimum convex polygons for females 221, 262, 283 in Kingsville, Texas, 2000.

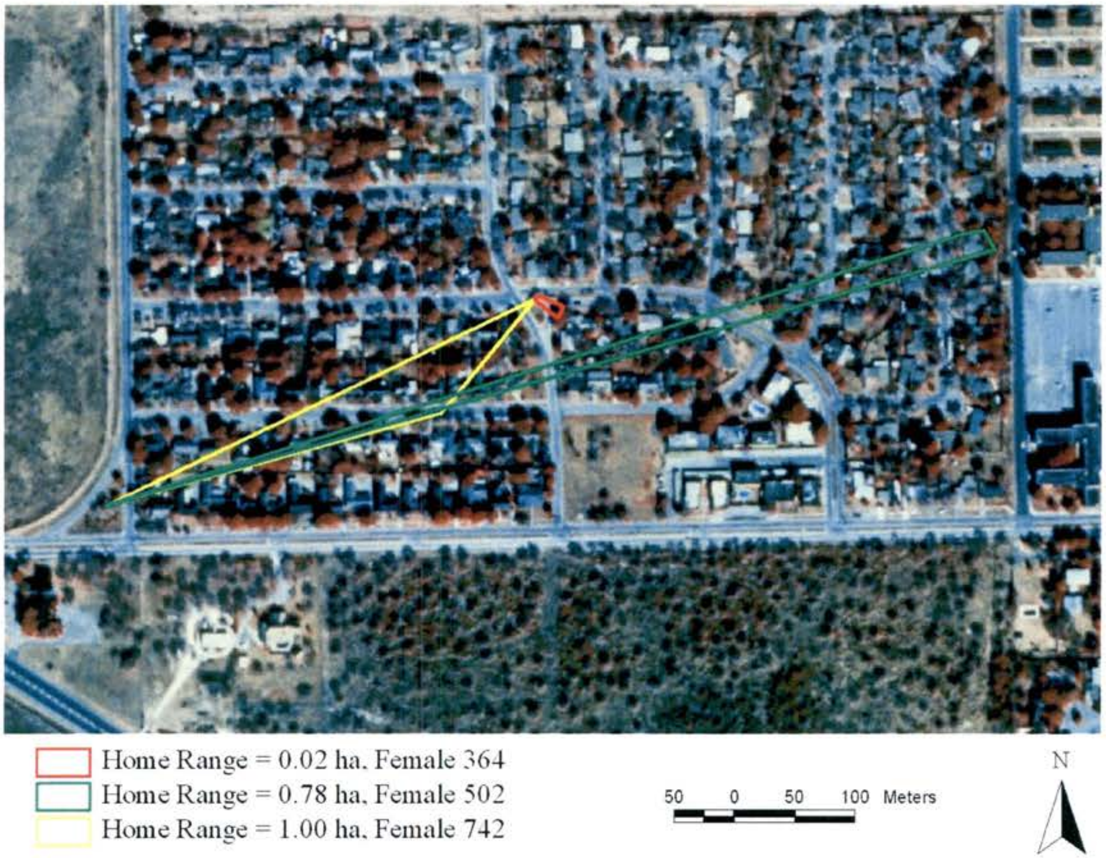

Figure 15. Minimum convex polygons for females 364, 502, 742 in Kingsville, Texas, 2000.

Figure 16. Minimum convex polygons for females 622, 801 in Kingsville, Texas, 2000.

Vita

Mark George Gray was born in Honolulu, Hawaii, on February 11, 1975, to the parents of Lynn Reid Gray and Robert George Gray. Mark graduated from James Bowie High School, Austin, Texas, in 1993. In the fall of 1993, Mark entered the University of Texas at Austin. Mark spent one summer taking marine classes at University of Texas at Port Aransas Marine Science center. He received his Bachelor of Science in 1997 from the University of Texas. Mark entered the Graduate School of Southwest Texas State University in the fall of 1999.

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