WINTERING PEREGRINE FALCONS (*FALCO PEREGRINUS*) ON SOUTH PADRE ISLAND, TEXAS

THESIS

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ABSTRACT

WINTERING PEREGRINE FALCONS (*FALCO PEREGRINUS*)

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By

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The Lower Laguna Madre Region of the Lower Texas coast is an important wintering area for a variety of birds many of which migrate from more northern latitudes. I studied Peregrine Falcons on South Padre Island (SPI), Texas, during winter 2001-2002 and 2002-2003. I captured falcons using standard falconry techniques and banded them with U. S. Fish and Wildlife Service aluminum leg bands. I captured 21 and 16 falcons in 2001-2002 and 2002-2003, respectively, and fitted 13 (2001-2002) and 6 (2002-2003) falcons with tail mounted radio transmitters to identify individuals throughout each winter. I analyzed mark-recapture data using the Jolly – Seber method, which provided an estimate of 6 to 9 falcons ($\bar{x}$ = 7.05, SE = 0.42) on SPI in 2001-2002 and 7 to 14 individuals ($\bar{x}$ = 8.9, SE = 1.2) in 2002-2003. The majority of falcons wintering on SPI were females with no detectable difference in number of adults or juveniles. In 2001-2002, falcons frequented the wind – tidal flat more than other habitats on SPI. In 2002-2003, more falcons frequented the vegetated barrier flat on the leeward side of the fore –

island dune ridge. This switch in habitat may be in response to a greater prey base at more fresh water pools within the vegetated barrier flat than in 2001-2002, however, the wind-tidal flat still was important to falcons in 2002-2003. Within year site fidelity was common in falcons during both winters. In 2002-2003, 3 of 4 falcons returning to the island were faithful to certain areas on SPI within 2.7 km of last encounter sites of the previous winter. The majority of prey eaten by peregrines consisted of shorebirds, primarily gulls (*Larus* sp.), which winter on SPI. I conducted a summer survey in 2002 and was unable to confirm the presence of any Peregrine Falcons on SPI between 19 May and 4 August.

INTRODUCTION

The peregrine falcon (*Falco peregrinus*), a cosmopolitan raptor, is a large, long – winged bird of prey of the order Falconiformes (Family: Falconidae). The North American subspecies, *F. p. tundris* and *F. p. anatum*, recently have been removed from state and federal endangered species lists as of 5 October 1994 and 25 August 1999, respectively.

The barrier islands along the coast of Texas are major migratory pathways for Peregrine Falcons (Enderson 1965, Hunt et al. 1975, Hunt and Ward 1988, Yates et al 1988) with *F. p. tundris* comprising the majority of these migrants. This concentration of migrating tundra falcons first was realized in the 1940s by Col. R. L. Meredith of Brownsville, Texas (Hunt and Rogers 1973, Hunt et al. 1975); although, records of peregrines in south Texas date back to 1890 (Griscom and Crosby 1925). According to band recovery data, most migrant falcons have origins in the Artic and winter in Central and South America (Yates et al. 1988). Little information exists on population estimates, demographics, predation, or winter ecology (Palmer 1988, Ratcliffe 1993, McGrady et al 2002) for coastal Texas. Enderson (1965) suggested that a substantial population of falcons winter along the Texas coast. Recent studies have verified that falcons do winter on South Padre Island (hereafter, SPI) and are not slow movers on a late migration (Enderson et al. 1995). Anecdotal data suggest that individual birds exhibit site fidelity, using the same areas within the Laguna Madre region each winter (T. Maechtle, per. comm.). Site fidelity in raptors is not uncommon especially for nesting/breeding

areas (Newton 1979), and for certain species, fidelity during winter has been documented (Enderson 1964, Mills 1975, Newton 1979, Harmata and Stahlecker 1993, Garrison and Bloom 1993). Newton (1979) emphasized the need for more information on site fidelity in raptors in wintering areas During a study in winter on SPI, 7 falcons were trapped, fitted with conventional telemetry equipment, and tracked to verify movements and other behaviors with 1 of the falcons being tracked in 1993 and 1994 (Enderson et al. 1995) indicating a possible fidelity for wintering areas in this population of peregrines. In addition, falcons tracked in winter (i.e., 1993 and 1994) frequented the Laguna Madre and the wind-tidal flats and occasionally brushlands and pastures west of the laguna but rarely the beach and gulf-side dunes. Hunt and Ward (1988) concluded that peregrines used wind-tidal flats over other habitats available during spring migration on SPI. A study conducted in Grays Harbor, Washington, revealed that 1 radio-tagged peregrine used mudflats more than 50% of the time (Dobler and Spencer 1989). Hunt and Ward (1988) also stated that C. Thelander and P. Bloom found Peregrine Falcons in a similar barren habitat on the coast of Peru. The featureless and unvegetated landscape of a wind-tidal flat provides conditions for prey vulnerability for falcons to exploit.

Land birds, such as Mourning Dove (*Zenaida macroura*), sparrows, shorebirds, and waterfowl, such as teal (*Anas* spp.), frequenting barrier islands are the principle prey of falcons during migration. Hunt et al. (1975) found passerines and other small land-birds (n = 53) made up 60% of prey taken by peregrines during fall migration. Mourning Doves (n = 12), sparrows (n = 11), and unidentified small passerines (n = 12) constituted the majority of small – class prey taken. Shorebirds (n = 26), such as the Willet (*Catoptrophorus semipalmatus*) (n = 3), Green-backed Heron (*Butorides striatus*) (n = 2),

Royal Tern (*Sterna maxima*) (n = 2), and Laughing Gull (*Larus atricilla*) (n = 2) composed 29% of prey species, whereas, waterfowl (n = 8) represented only 9%. The prey most commonly is taken by peregrines in direct pursuit usually from above or by driving it into the surf or water where it can easily be caught (Hunt et al. 1975). In a study near Sequim, Washington (Dobler 1993), wintering peregrines were observed preying on 22 different species of birds with no single group of prey being selected over another. In a study on the west coast of Mexico near Culiacán, Sinaloa (Enderson et al 1991), a region with habitat similar to the Texas coast, 14 teal representing 3 species were taken by wintering peregrines. Furthermore, prey remains from known peregrine kills included a White-winged Dove (*Z. asiatica*), a Cattle Egret (*Bubulcus ibis*), and 3 unidentified shorebirds. Enderson et al. (1995) observed wintering Peregrine Falcons on SPI catch a Redhead (*Aythya americana*), a Northern Pintail (*A. acuta*), a Forster's Tern (*S. forsteri*), and a Laughing Gull. Breeding populations of peregrines near the community of Rankin Inlet, Northwest Territories (Court et al. 1988), preyed on 19 species of birds and 3 species of mammals and demonstrated considerable prey flexibility. Hunt et al. (1975) made a comparison of prey types taken by peregrines in Texas during fall migration with breeding falcons in Alaska (Cade 1960) and reported the percentages were similar.

In Sinaloa, Mexico, Enderson et al. (1991) noted that most wintering peregrines in that region were adult females (77%). Also, male falcons of both immature and adult plumage constituted a very small proportion of the wintering population, and all 3 subspecies may have been present. The competition and threat of predation by the larger

females most likely discourages males from using the same areas as females during the non-breeding season.

On SPI and areas west of the island, Enderson et al. (1995) saw about 20 individual peregrines and estimated a minimum wintering density of 1 falcon per 50 km^2. In addition, on tidal flats north of the Mansfield Channel, there may have been as many as 60 wintering falcons based on information gathered on SPI in 1994. Enderson et al. (1995) also suggested that falcons may spend their first summer on SPI.

The objectives of my study were to 1) estimate the population of wintering Peregrine Falcons on SPI, 2) estimate the sex and age ratios of wintering peregrines on SPI, 3) identify habitat use and document individual site fidelity within seasons and between seasons for returning falcons, 4) make an inference to wintering peregrine prey use on SPI, and 5) determine if Peregrine Falcons spend their first summer on SPI.

MATERIALS AND METHODS

Study Site

SPI is the southern most barrier island along the Texas coast. The island was formed 2000 to 3500 years ago from river delta sediment interacting with a rising sea level (Brown et al. 1980) SPI is about 65 km long, less than 1.5 km wide on the southern end and about 6.0 km at its widest point on the northern end near the Mansfield Channel. Three major topographic features comprise the island from east to west: 1) beach, 2) gulf – side dune formation, and 3) vast wind – tidal flats Several hurricane washes, which are similar to flats in that they are featureless and unvegetated, are scattered along the island and extend out into tidal flats. These washover channels provide the only view of wind-tidal flats from the 150 – m wide beach (Hunt and Ward 1988). The gulf – side dune formation, up to 10 m in elevation, runs along the coast continuously except at washover channels Sparse salt tolerant grasses and vines dominate the vegetation on dunes. Small marsh-like pools may form after heavy rainfall. Vegetated barrier flats also exist in the dune system. The wind – tidal flats of sand and mud extend along most of the western edge of the island and frequently are inundated by wind driven and tidal surge water from the Laguna Madre. A portion of the western edge of the wind – tidal flat supports large mats of blue-green algae (*Nostoc* spp.) (Hunt and Ward 1988). A shallow bay, the lower Laguna Madre, separates the island from the mainland, and the Mansfield Channel separates SPI from North Padre Island.

Study Design

I searched for Peregrine Falcons on SPI during the winters of 2001 – 2002 and 2002 – 2003. I divided the search area into 5 sections that extended north about 55 km from the end of the public road out of the SPI settlement to the Mansfield Channel. Each section contained 4 transects: a beach transect, a transect along the western edge of the vegetated barrier flat, and 2 transects on the wind-tidal flats (on the laguna side and through the center of the wind-tidal flats) (Fig. 1). I established transects by set bearings using a Garmin 12 XL GPS (Garmin International, Olathe, KS). The GPS coordinates allowed survey replication. Data collection began 1 December and ended 31 March of each year. Every other week I traveled the 4 transects in the 5 sections in a random order determined by principles in a Latin square randomization (Quinn and Keough 2002). In the 2001 – 2002 season, I randomized the order by which sections and transects within each section were attended. This presented a problem within sections because I often observed falcons off the scheduled transect in a given section while in route to survey a scheduled transect. Travel time also was greater during the 2001 – 2002 season, which translated into greater logistical costs. In 2002 – 2003, the Latin square randomization was used only to determine the order sections were attended in a given sample. I traveled transects within each section in an order to minimize time and the possibility of off transect observations of falcons thereby making the surveys more efficient.

I attempted to trap every falcon seen while traveling along a transect. I captured falcons using standard falconry techniques similar to those described by Beebe and Webster (2000) and restrained them using an Aba (Maechtle 1998). I banded falcons with U.S. Fish and Wildlife Service aluminum leg bands and fitted them with transmitters

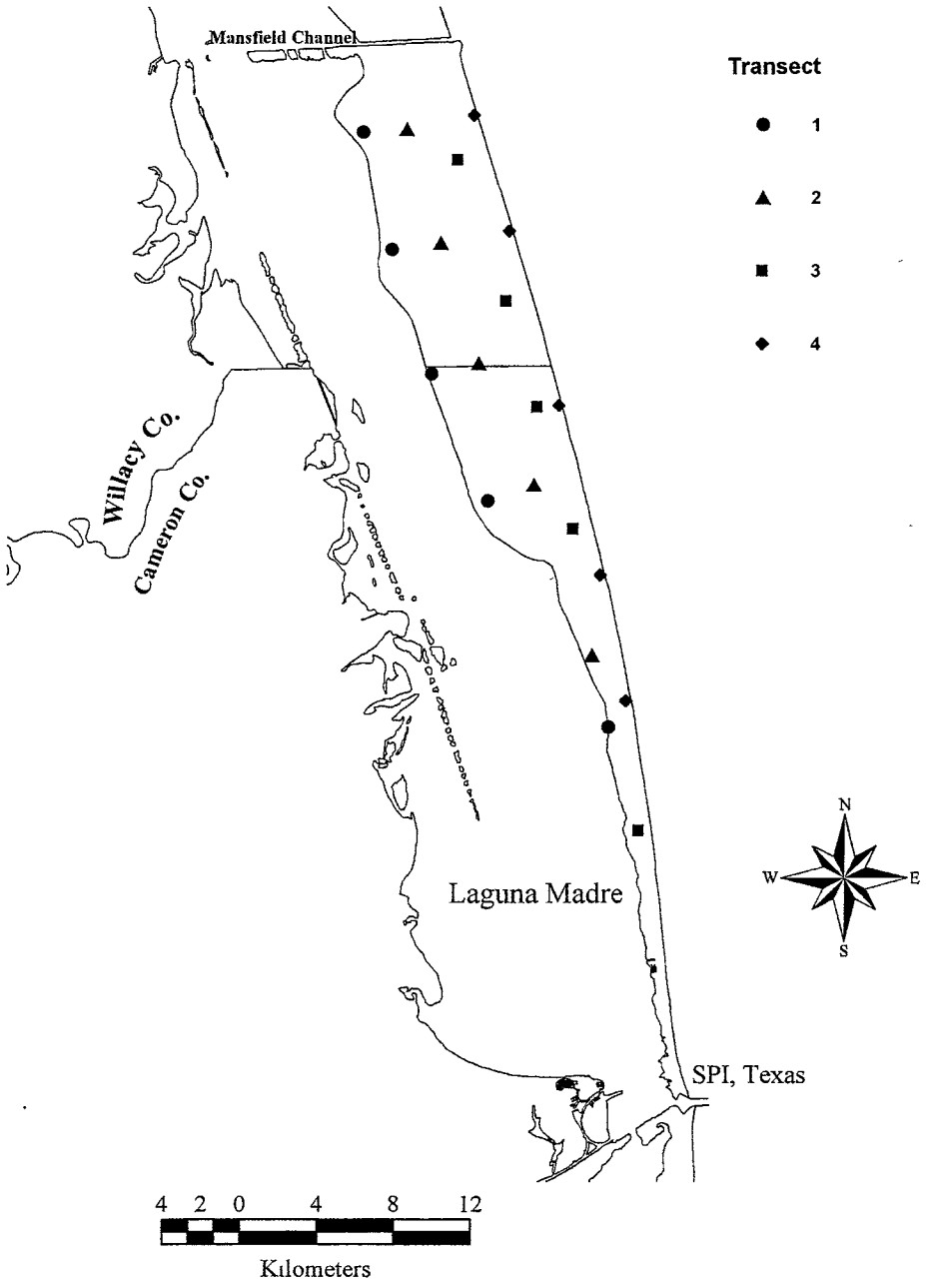

Figure 1. Study site and approximate locations of transects on South Padre Island, Texas. *Note: (1 = laguna side of wind – tidal flat, 2 = center of the wind – tidal flat, 3 = western edge of vegetated barrier flat, and 4 = beach)

attached to central rectrices (Dunstan 1973 and Enderson et al. 1991). Transmitters were lost during the subsequent summer molt. The tail mounted transmitters (Wildlife Materials, Inc., Carbondale, IL) were ≤ 2 % of falcon's mass (Samuel and Fuller 1994) I used transmitters weighing about 6 grams on male and/or female falcons and those weighing about 9 grams exclusively on larger female falcons. I fitted 13 falcons with tail mounted transmitters in 2001 – 2002 (Appendix 1) and 6 falcons in 2002 – 2003 (Appendix 2). Receiving equipment included a 3 – element yagi antenna coupled with a Wildlife Materials, Inc TRX-1000 receiver. Because peregrines can easily become trap shy (T. Maechtle, per. comm.), the transmitters provided recapture data with minimal disturbance to an individual falcon for the length of the study. For every peregrine observed and identified by telemetry, I recorded a band return / recapture for that individual without actually capturing the falcon. I used telemetry and GPS location data on radiotagged individuals to map distributions. Age, sex, and weight were recorded for every trapped bird, and prior to release, birds were marked with Rhodamine-B on the breast and auricular feathers to avoid unnecessary retraps during the same trapping event. Once a trapped bird was marked and released, I returned to the transect and continued until another bird was seen or the transect was completed. I observed birds that could not be trapped through 8x binoculars to estimate the falcons' sex and age. Sex was ascertained by relative size and wing beat (Enderson et al. 1991), and I used plumage characteristics in determining the age of falcons (Hunt et al. 1975). I recorded the time of peregrine encounters, temperature, wind speed and direction, and cloud cover while in the field. Surveys began at dawn and ended when all scheduled transects had been traveled. I also made note of foraging behavior and examined prey remains and falcon

castings while running the transects. Peregrine Falcons were banded under Texas Scientific Permit SPR-0390-047. Radio transmitter use was conducted under Texas Scientific Permit SPR-0890-234. Procedures used in animal capture and handling were approved by the Texas State Institutional Animal Care and Use Committee under project Wintering Peregrine Falcons on South Padre Island, permit 5QHXOQ-02.

Population Estimates

I used the Jolly – Seber method for open populations to estimate the population of wintering Peregrine Falcons on SPI. Gould and Fuller (1995) recommended the Jolly – Seber method for analyzing capture – recapture data in raptor population studies. This method gave estimates for population size for each of the sampling events except the first and last samples for which estimates cannot be calculated (Krebs 1999). Also, the first sample in the 2001 – 2002 season (8 – 10 and 13 December 2001) and the sixth sample in the 2002 – 2003 season (1 – 2 April 2003) were omitted from the analyses because flooding made several transects inaccessible on the wind-tidal flats. I calculated population size estimates along with 95% confidence intervals using the software program MARK – RECAPTURE, Model A (Krebs 1999).

Population Demographics

I used a Fisher's Exact Test ($\alpha = 0.05$) to determine if any significant differences in proportionality existed between sex (tertiary and quaternary ratios) and age classes of captured falcons in each season (2001 – 2002 and 2002 – 2003). I used a Chi-square statistic (χ^2, $\alpha = 0.05$) to test for differences in frequencies of females to males from the

expected 1:1 ratio within each age class (juvenile and adult) captured in each season. I used the Statview for Windows (Version 5.0) statistical program for all Chi-square analyses. I only used captured falcons in both analyses to eliminate any uncertainty about the age or sex of a bird.

Habitat Use and Individual Site Fidelity

The total number of observations of falcons on each transect (i.e., beach, vegetated barrier flat, and the 2 wind – tidal flat transects) in each section were summed for analyzing habitat use across transects. I omitted the first sample in the 2001 – 2002 season (8 – 10 and 13 December 2001) and the sixth sample in 2002 – 2003 (1 – 2 April 2003) from analyses. I analyzed habitat use in both seasons using a Chi-square statistic (χ^2, $\alpha = 0.05$) to determine if falcon observations were equally distributed across transects in the expected proportion of 1:1:1:1.

To document individual site fidelity in both seasons and season to season for returning falcons, I pooled location data (band number, date of encounter, time of encounter, UTM coordinates, and transect) for each individual and placed them in a spreadsheet for interpretation. For individuals encountered 2 or more times in a season, I calculated distance measurements for each observation in relation to the initial capture For individuals encountered 3 or more times in a season, I calculated distance measurements for each observation in relation to the prior observation. I calculated days since initial capture (i.e., tenure) and last observation for all observations where applicable to describe the tenacity of an individual falcon for an area on SPI in each season. In addition, I assumed falcons were present and remained in the area (i.e., SPI)

between survey periods (Mills 1975). To identify falcons as winter residents, I set a guideline minimum of a 24 – day tenure with at least 2 observations during that tenure for each individual (Enderson 1964)

I identified season to season site fidelity in returning falcons by calculating the distance between the last observation in 2001 – 2002 and the initial capture site in 2002 – 2003, the initial captures of both seasons, and/or 2 encounters about 365 days apart. In addition, I used the number of days from the last observation in 2001 – 2002 to the initial encounter in 2002 – 2003 for each returning falcon to explain season to season fidelity.

Prey Use

I investigated prey use by examining castings and prey remains at known falcon perches and elsewhere on SPI. Based on my observations of Peregrine Falcons and other Falconidae feeding on prey and Palmer (1988), I identified prey remains as a peregrine kill if the keel of the prey was notched Castings and prey remains were examined following Marti (1987). I also used observations of falcons taking prey, and if the prey item could not be identified from a distance, the remains were examined for identification once the falcon finished feeding and/or left the area. Based on the frequency and percent occurrence of each prey species taken by falcons, I constructed a profile of the diet.

Summer Survey

To determine if juvenile peregrines spend their first summer on SPI, I visited the island in May, June, July, and August 2002 (after the spring migration) and searched along the established transects for juvenile falcons via direct observation and for juvenile

falcons outfitted with transmitters from the previous winter. These data were recorded as presence / absence of juvenile Peregrine Falcons on SPI.

RESULTS

I spent a total of 362.5 hours searching for falcons on SPI in 2001 –2002 and 2002 – 2003 combined. During surveys, I made a total of 192 observations of Peregrine Falcons, which equated to about 0.53 observations per hour

In the 2001 – 2002 season, I spent a total of 216.5 hours searching for peregrines and made 129 observations (0.6 observations per hour). The highest number of observations of falcons per hour occurred in the first 2 (0.65 and 0.71, respectively) and last 2 (0 79 and 0.86, respectively) surveys with a decreasing trend in observations per hour for the 20 – 23 December survey to the 2 – 3 and 7 February survey with a subsequent increasing number until the last survey (Table 1, Fig. 2).

I spent a total of 146 hours surveying for falcons in the 2002 – 2003 season. I made 63 observations with 0.43 observations per hour. Furthermore, the greatest number of observations per hour occurred in the first (0.51) and last 3 (0.67, 0.56, and 0.60, respectively) surveys (Table 2, Fig. 3). A similar trend in the number of falcons observed per hour occurred in 2001 – 2002.

Population Estimates

During 2001 – 2002, 21 peregrines were captured and released on SPI (Appendix 1) with 19 (90.5%) included in analyses Of the 19 individuals, 52.6% (10) were recaptured at least once on a transect during the remainder of the season. For the 4 – 6 January survey to the 16 – 22 March survey, the estimated population of Peregrine

Table 1. Summary of the number of Peregrine Falcons observed and number of hours of survey effort on 20 transects for winter 2001 - 2002 on South Padre Island, Texas

Survey Period	No. Falcons Observed	Total Survey Time (hours)	No. Falcons Observed / Hour
8 - 10; 13 Dec	17	26.0	0.65
20 - 23 Dec	21	29.5	0.71
4 - 6 Jan	14	29.0	0.48
18 - 20 Jan	9	24.0	0.38
2 - 3; 7 Feb	7	23.5	0.30
16 - 17 Feb	13	20.5	0.63
1 - 4 Mar	12	20.0	0.60
16 - 17; 21 - 22 Mar	21	26.5	0.79
31 Mar - 1 Apr	15	17.5	0.86
Total	**129**	**216.5**	0.60
Avg. per survey	**14.33**	**24.06**	0.60
Standard Error	**1.61**	**1.38**	

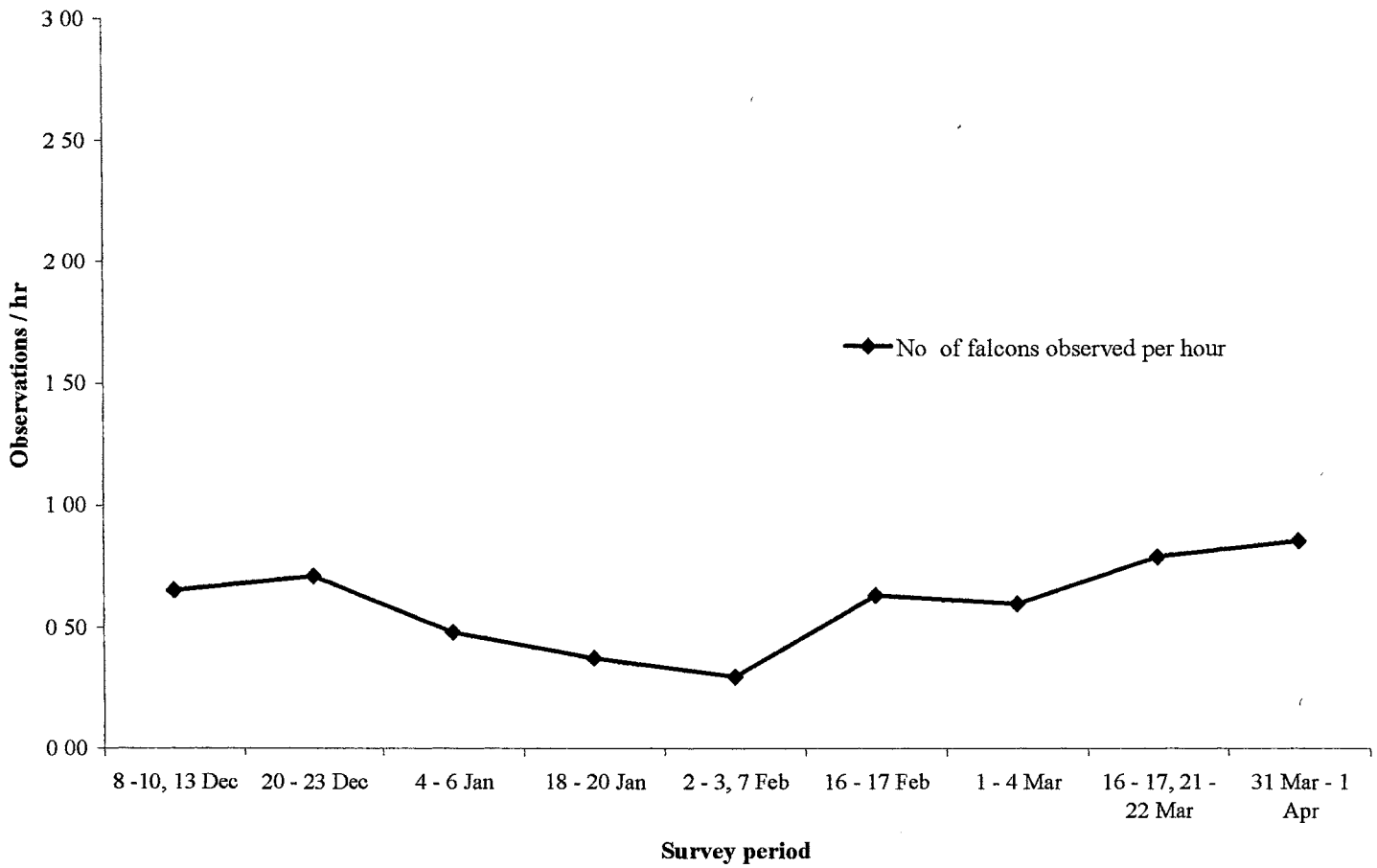

Figure 2 The number of falcons observed per hour per survey period on South Padre Island, Texas, during winter 2001 - 2002

Table 2. Summary of the number of Peregrine Falcons observed and number of hours of survey effort on 20 transects for winter 2002 - 2003 on South Padre Island, Texas.

Survey Period	No. Falcons Observed	Total Survey Time (hours)	No. Falcons Observed / Hour
21 - 22 Dec	9	17.75	0.51
4 - 5 Jan	7	19.00	0.37
18 - 19 Jan	4	19.50	0.21
30 - 31 Jan	7	22.00	0.32
16 - 17 Feb	4	15.25	0.26
1 - 2 Mar	11	16.50	0.67
16 - 17 Mar	10	17.75	0.56
30 - 31 Mar	11	18.25	0.60
Total	**63**	**146**	0 43
Avg. per survey	**7.88**	**18.25**	0.43
Standard Error	**1.01**	**2.03**	

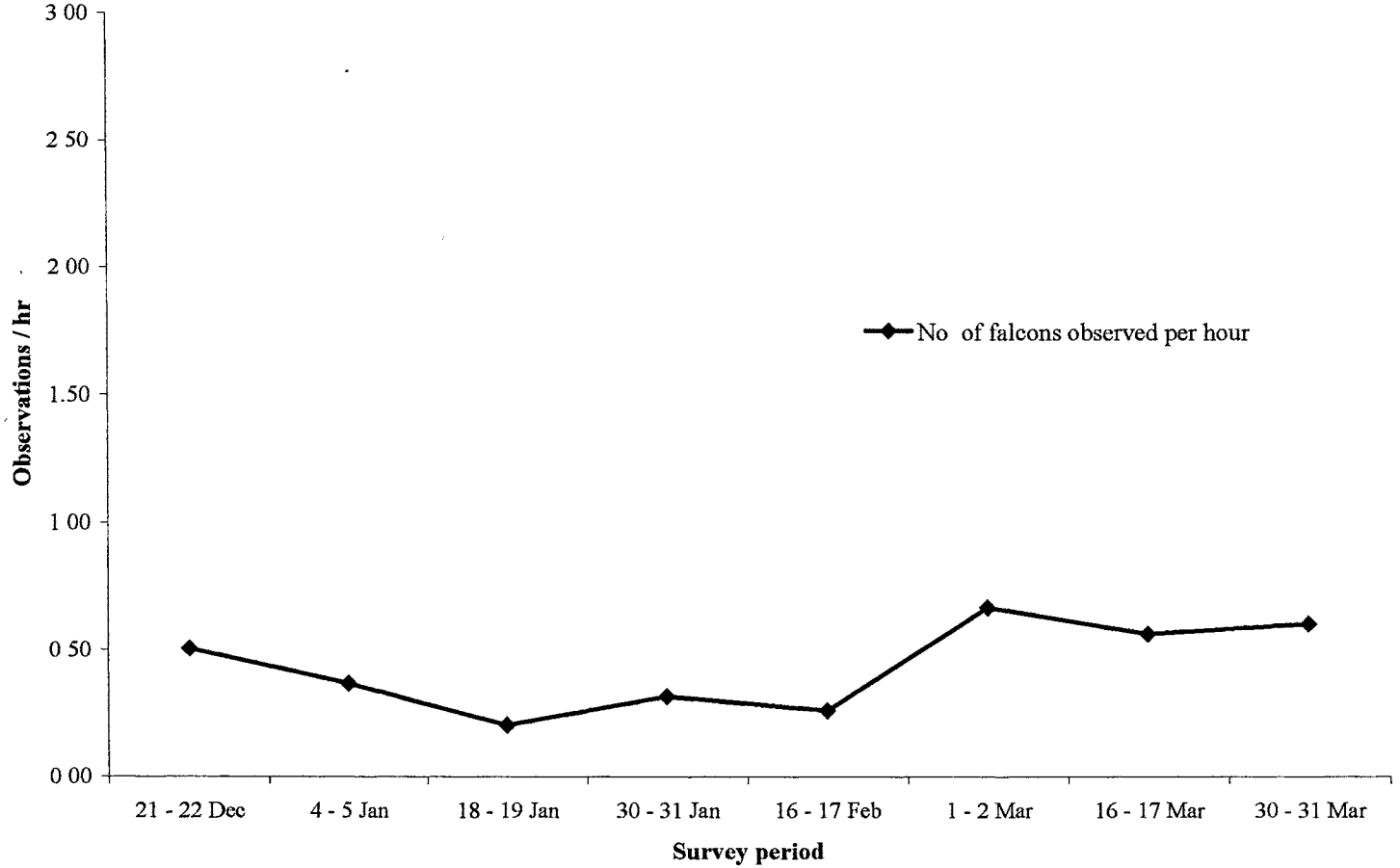

Figure 3 The number of falcons observed per hour per survey period on South Padre Island, Texas, during winter 2002 - 2003

Falcons ranged from 6 to 9 individuals ($\bar{x}$ = 7.05, SE = 0.42). Based on the variable size of the confidence intervals, the best population estimates occurred on and after the 2 – 7 February survey. A slight increase in the population estimate occurred on the next to last (16 -22 March) survey (Table 3, Fig. 4)

During 2002 – 2003, 16 peregrines were captured and released on SPI (Appendix 2) with 14 (87.5%) included in the analysis. Of the 14 individuals, 57.1% (8) were recaptured at least once on a transect during the remainder of the season For each survey from 4 – 5 January to 16 – 17 March survey, the estimated population of falcons ranged from 7 to 14 individuals ($\bar{x}$ = 8.9, SE = 1.2). The highest estimate of 13.5 (SE = 5.7) individuals had large confidence intervals (8.3 to 32.9) and occurred on 30 – 31 January; however, I had only 2 captures and 3 recaptures with an overall total of 6 observations of falcons. As in the 2001 – 2002 population estimate, a slight increase in the population estimate occurred on the second to last (16 -17 March) survey (Table 4, Fig. 5).

Population Demographics

Of 21 falcons captured during 2001 – 2002, 9 were juvenile females, 10 adult females, and 2 adult males; no juvenile males were captured. Only 10.5% of falcons captured were males. There was no significant difference in proportionality between all sex and age classes (i.e., age is independent of sex) in 2001 – 2002 (Fisher's exact; p = 0.49). Although, sex ratios deviated from the expected 1:1 ratio of females to males within each age class (juvenile: $\chi^2 = 9.0$, df = 1, p = 0.003; adult: $\chi^2 = 5.3$, df = 1, p = 0.021) and for age classes combined ($\chi^2 = 13.76$, df = 1, $p < 0.001$).

Table 3. Population estimates for each survey period for wintering Peregrine Falcons on South Padre Island, Texas, 2001 - 2002. The 95% confidence intervals are shown along with the estimates.

Survey Period	Total Population		
	Low	Estimate	High
20 - 23 Dec	*	*	*
4 - 6 Jan	6.8	6.8	22.4
18 - 20 Jan	4.9	8.0	19.2
2 - 7 Feb	5.8	5.8	12.1
16 - 17 Feb	5.2	6.3	10.6
1 - 4 Feb	5.1	6.9	12.3
16 -17; 21 - 22 Mar	7.2	8.5	14.3
31 Mar - 1 Apr	*	*	*

* No estimate can be made of this parameter from the available data.

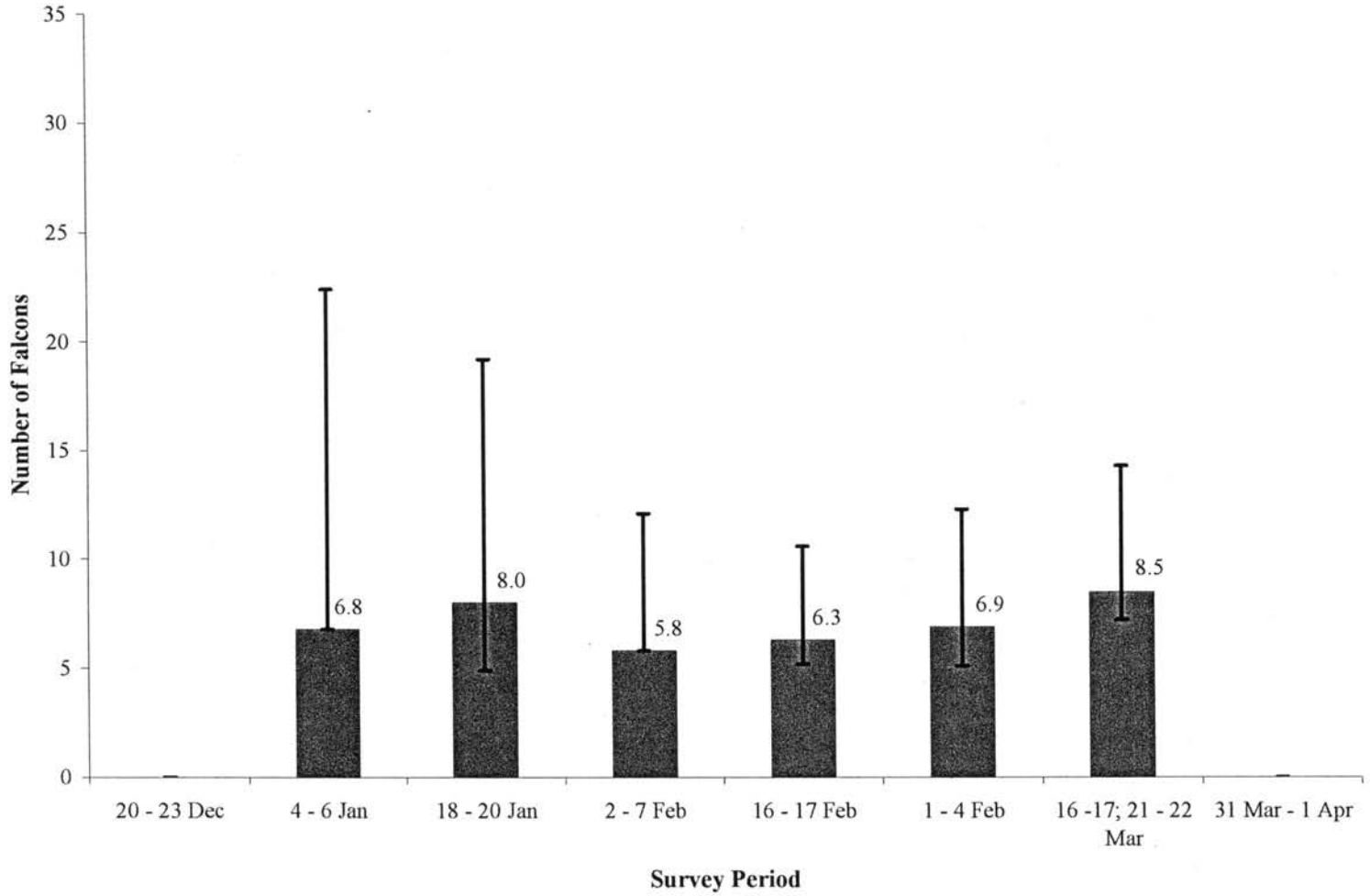

Figure 4. Population estimates with 95% confidence intervals per survey period for the wintering population of Peregrine Falcons on South Padre Island, Texas, 2001 - 2002. *Note: Estimates could not be made for the first and last survey periods given the available data.

Table 4. Population estimates for each survey period for wintering Peregrine Falcons on South Padre Island, Texas, 2002 - 2003. The 95% confidence intervals are shown along with the estimates.

Survey Period	Total Population		
	Low	Estimate	High
21 - 22 Dec	*	*	*
4 - 5 Jan	6.0	7.4	15.4
18 - 19 Jan	6.0	7.5	11.2
30 - 31 Jan	8.3	13.5	32.9
16 - 17 Feb	7.0	7.0	7.0
16 - 17 Mar	6.1	9.0	18.5
30 - 31 Mar	*	*	*

* No estimate can be made of this parameter from the available data.

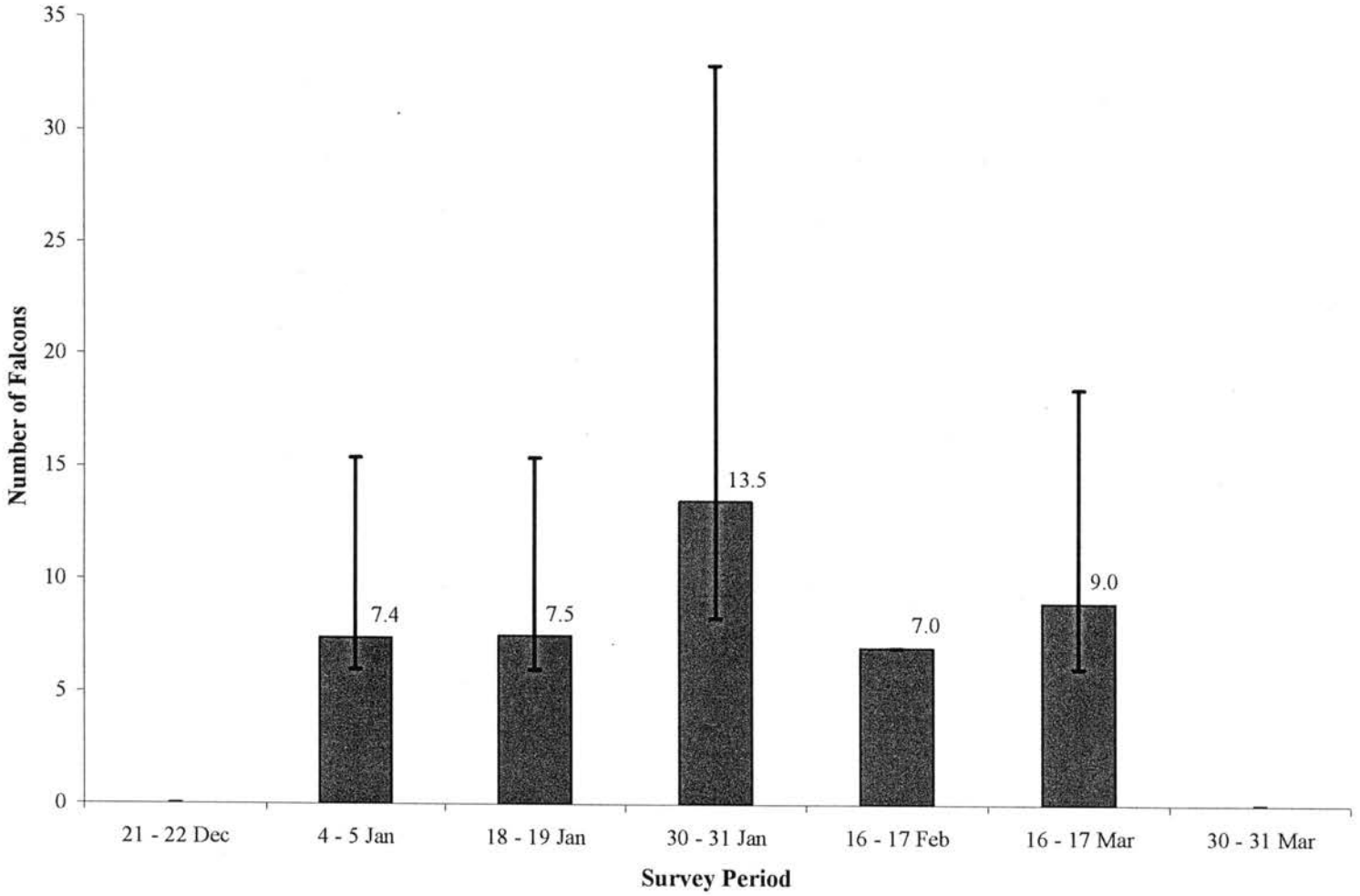

Figure 5. Population estimates with 95% confidence intervals per survey period for the wintering population of Peregrine Falcons on South Padre Island, Texas, 2002 - 2003. *Note: Estimates could not be made for the first and last survey periods given the available data.

Of 16 falcons captured during 2002 – 2003, 11 were juvenile females and 5 adult females; no males were captured. There was no significant difference in proportionality between all sex and age classes (i.e., age is independent of sex) in 2001 – 2002 (Fisher's exact; $p = 1.0$). Although, sex ratios deviated from the expected 1·1 ratio of females to males within each age class (juvenile: $\chi^2 = 11.0$, $df = 1$, $p = 0.001$, adult: $\chi^2 = 5\ 0$, $df = 1$, $p = 0.025$) and for age classes combined ($\chi^2 = 16.0$, $df = 1$, $p < 0.0001$).

Habitat Use

I made 84 observations of habitat use by Peregrine Falcons in 2001 – 2002. Of those 84 observations, 36 (42.86%) occurred on the laguna side of the wind – tidal flat transect (i.e., #1 transects), 29 (34.52%) on the center of the wind – tidal flat transect (i.e., #2 transects), 11 (13.10%) on the leeward side of the vegetated barrier flat and dunes (i.e., #3 transects), and 8 (9.52%) on the beach transect (i.e., #4 transects). Falcons were not observed proportionally across transects ($\chi^2 = 26.57$, $df = 3$, $p < 0.00001$) (Table 5). The greatest number of observations (n = 12, 14.29%) for all observations occurred on transect A1, and 33.3% of observations were on #1 transects. Transects on the wind – tidal flat (C1, C2, and E2) had 8 (9.52%) observations each (Table 6).

I made 42 observations of falcons on transects in 2002 – 2003. Of those 42 observations, 10 (23.81%) were on #1 transects, 12 (28.57%) on #2 transects, 12 (28.57%) on #3 transects, and 8 (19.05%) on #4 transects. Unlike the 2001 – 2002 season, falcons were observed proportionally across transects ($\chi^2 = 1.048$, $df = 3$, $p = 0.790$) (Table 7). I made no observations on 5 transects (C4, D1, D3, D4, and E4) with 3

Table 5. Frequency of observations of Peregrine Falcons on the 4 transect types* on South Padre Island, Texas, during 2001 – 2002. Null hypothesis of proportional occurrence to the expected 1:1:1:1 ratio on transects was rejected ($\chi 2 = 26.571$, df = 3, $p < 0.00001$).

Transect	No. of Observations	% Occurrence
1	36	42.86
2	29	34.52
3	11	13.10
4	8	9.52
Total	**84**	**100.00**

* Transect locations: 1 - laguna side of wind-tidal flat, 2 - center of wind-tidal flat, 3 - west edge of vegetated barrier flat (e.g., dunes), 4 - beach

Table 6. Frequency of observations of Peregrine Falcons on each transect* by section** on South Padre Island, Texas, during 2001 – 2002.

Transect	No. of Observations	% Occurrence
A1	12	14.29
A2	6	7.14
A3	3	3.57
A4	4	4.76
B1	6	7.14
B2	5	5.95
B3	4	4.76
B4	2	2.38
C1	8	9.52
C2	8	9.52
C3	1	1.19
C4	1	1.19
D1	5	5.95
D2	2	2.38
D3	2	2.38
D4	1	1.19
E1	5	5.95
E2	8	9.52
E3	1	1.19
E4	0	0.00
Total	**84**	**100.00**

* Transect locations: 1 - laguna side of wind-tidal flat, 2 - center of wind-tidal flat, 3 - west edge of vegetated barrier flat, 4 - beach

** Section arrangement on the island: A to E = northernmost to southernmost

Table 7 Frequency of observations of Peregrine Falcons on the 4 transect types* on South Padre Island, Texas, during 2002 – 2003. Null hypothesis of proportional occurrence to the expected 1:1:1.1 ratio on transects was accepted ($\chi 2 = 1.048$, df = 3, p = 0.790)

Transect	No. of Observations	% Occurrence
1	10	23.81
2	12	28.57
3	12	28.57
4	8	19.05
Total	**42**	**100.00**

* Transect locations: 1 - laguna side of wind-tidal flat, 2 - center of wind-tidal flat, 3 - west edge of vegetated barrier flat (e.g , dunes), 4 - beach

of the 5 transects being beach (i.e., #4) transects. Transects with at least 4 observations included A3 (n = 4, 9.52%), A4 (n = 6, 14.29%), B1 (n = 4; 9.52%), and B3 (n = 5, 11.90%) (Table 8).

Site Fidelity

In 2001 – 2002, 8 falcons (4 adults and 4 juveniles) exhibited some degree of site tenacity and were considered residents by having a tenure of at least 24 days on the island (Appendix 3). I last observed juvenile female falcon (#1807-86394) banded on 9 December 2001 on 6 January 2002. During her 28 – day tenure, I encountered her 4 times, usually within 6.2 km of the initial trap location. One encounter (23 December 2001) occurred 13.8 km from and 14 days after the first encounter (Fig. 6).

On 10 December 2001, I captured an adult male falcon (#816-64045) on the southern end of the island on the wind – tidal flat. The second encounter would not occur until 69 days later on 17 February 2002 and nearly 31 km north of the initial capture site The next encounter occurred 25 days later at 1507 h on 14 March 2002. I detected a weak signal from his transmitter to the west at the intersection of General Brant Road and Highway 510 just south and west of Laguna Atascosa National Wildlife Refuge. Not an hour later, I observed him perched on the causeway to SPI, which is about 14.8 km from the initial capture site and 45 5 km from the last encounter on SPI. The last observation of this male falcon occurred 97 days after and 9.3 km from the capture site on 17 March 2002 (Fig. 7)

I captured and banded a juvenile female (#1807-52635) on 23 December 2001 I encountered her a total of 5 times during a tenure of 71 days. This particular bird,

Table 8. Frequency of observations of Peregrine Falcons on each transect* by section** on South Padre Island, Texas, during 2002 – 2003

Transect	No. of Observations	% Occurrence
A1	3	7.14
A2	2	4 76
A3	4	9.52
A4	6	14.29
B1	4	9.52
B2	3	7.14
B3	5	11.90
B4	2	4 76
C1	1	2.38
C2	3	7.14
C3	2	4.76
C4	0	0.00
D1	0	0.00
D2	2	4.76
D3	0	0.00
D4	0	0.00
E1	2	4.76
E2	2	4.76
E3	1	2.38
E4	0	0.00
Total	**42**	**100.00**

* Transect locations: 1 - laguna side of wind-tidal flat, 2 - center of wind-tidal flat, 3 - west edge of vegetated barrier flat, 4 - beach

** Section arrangement on the island: A to E = northernmost to southernmost

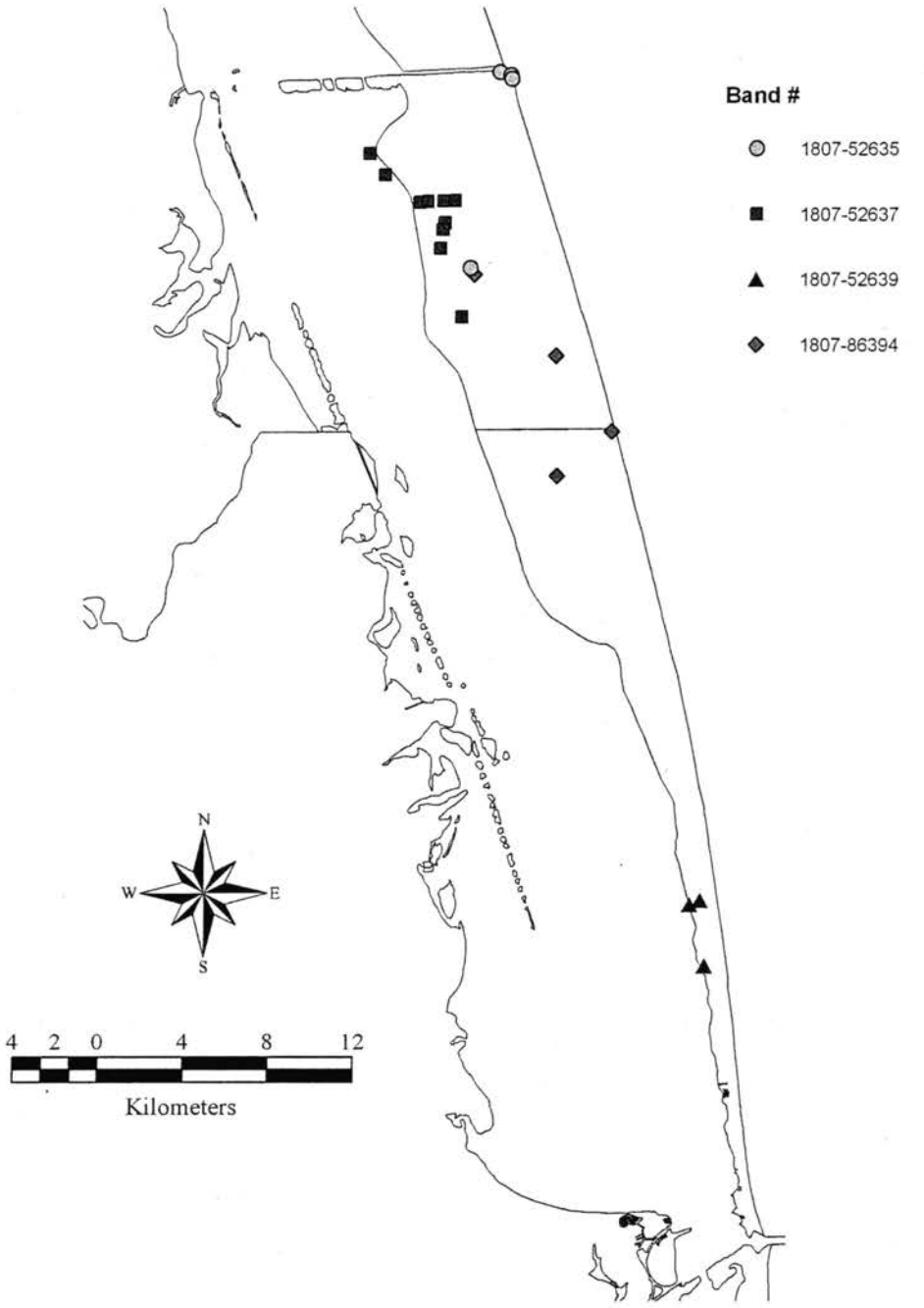

Figure 6. Locations of juvenile Peregrine Falcons on South Padre Island, Texas, in winter 2001 – 2002.

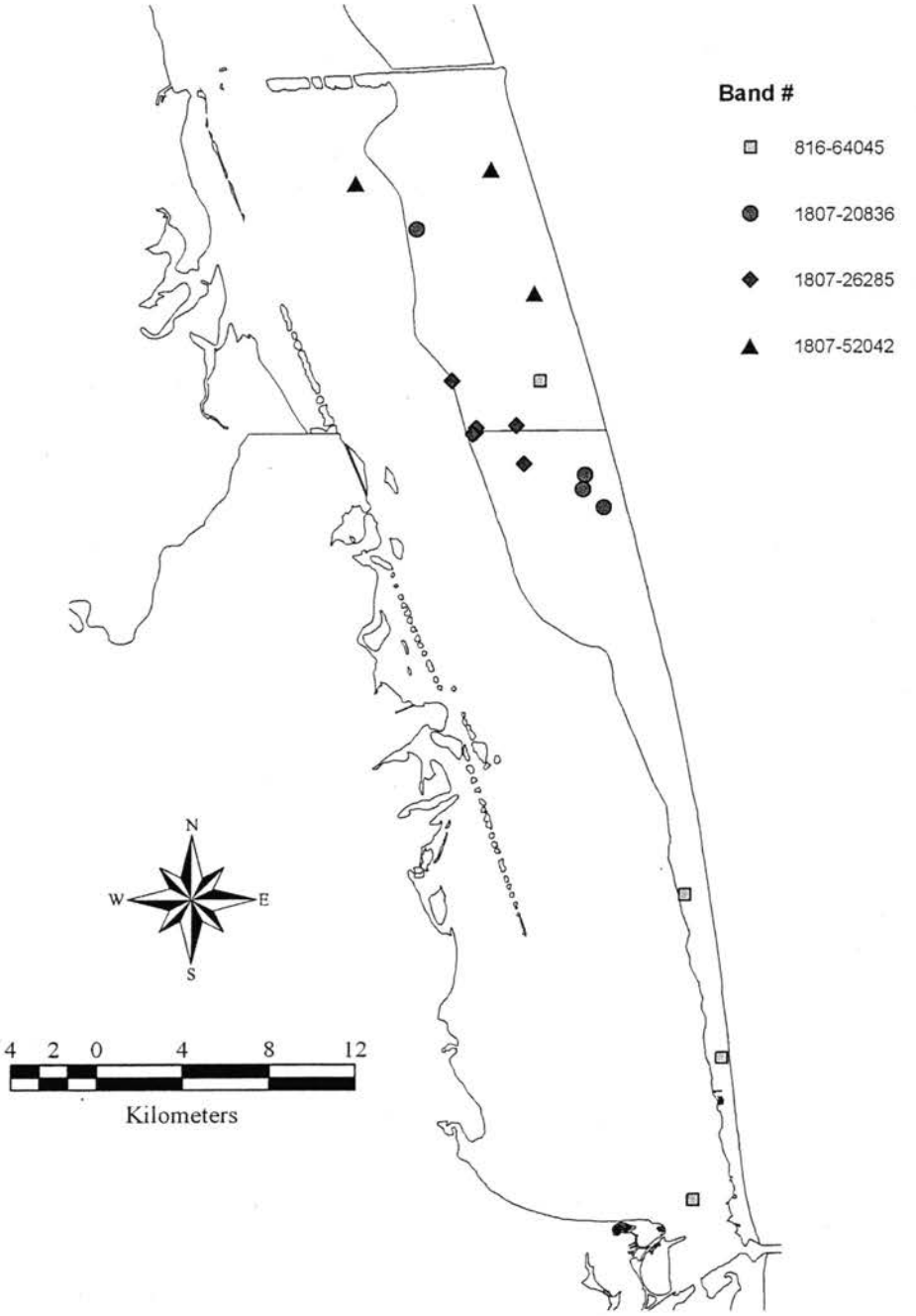

Figure 7. Locations of adult Peregrine Falcons on South Padre Island, Texas, in winter 2001 – 2002.

although trapped on the wind – tidal flats, was observed perched on the Mansfield Channel east jetty marker lights or on dunes at the channel 4 of 5 times (80%) and always within a kilometer of the last encounter location (Fig. 6).

The next falcon trapped (4 January 2002) on SPI that exhibited fidelity for a specific site was an adult female (#1807-26285). She frequently perched on a metal structure (3 of 6 encounters) just west of transect C1 west of Deer Island, a relatively large island of vegetated flats and dunes on the northern end of the island. The last observation of this falcon occurred on 16 March 2002 about 3.7 km from the initial trap site. Her tenure on SPI was at least 71 days (Fig. 7).

The fifth falcon captured on SPI was a juvenile female (#1807-52637) The capture occurred on 6 January 2002 on the northern part of the wind – tidal flats. I observed her about every 11 to 14 days during her minimum 85 day tenure on the island. In addition, she rarely was seen more than 2.0 km from her capture site. I last encountered her on 1 April 2002 (Fig. 6).

An adult female (#1807-52042) captured on 6 January 2002 was encountered 2 times 27 days later 7.7 km and 13.4 km, respectively, from where she was initially captured (Fig. 7).

On 17 February 2002, the seventh falcon to exhibit site fidelity was a juvenile female (#1807-52639) captured on the southern part of the island. During her minimum 42 – day tenure, she was encountered within 3.3 km of her initial trap site (Fig. 6)

The last falcon captured during 2001 – 2002 that exhibited site fidelity on SPI was an adult female (#1807-20836). Two of the 3 encounters after she was captured were within 2.5 km of the initial trap site. Her tenure was at least 30 days (Fig. 7).

In 2002 – 2003, 7 falcons exhibited some degree of site tenacity and residency by having a tenure of at least 24 days on the island (Appendix 4). Of the 7 falcons considered residents during 2002 – 2003, 42.9% were adult falcons.

I captured an adult female (#1807-52635) on 22 December 2002 She often perched on the Mansfield Channel east jetty marker lights. I encountered her nearly every 12 to 14 days except during the 16 – 17 February survey. Her tenure on SPI was a minimum 98 days, the longest tenure of all resident Peregrine Falcons during my study (Fig. 8)

A juvenile female (#1807-52619) trapped on 22 December 2002 had an 84 – day tenure. I encountered her 6 times usually every 12 to 14 days. I rarely observed her within 16 km of her initial trap site and 10 km from the previous encounter. She was seen last on 16 March 2003 (Fig. 9).

Two encounters of a juvenile female (#1807-52620) occurred 98 days apart on 22 December 2002 and 30 March 2003 within 1.2 km of each other. Considering the amount of time between encounters and the timing of those encounters, this bird may have been a late fall and early spring migrant that did not winter on the island (Fig. 9)

I observed an adult female (#1807-52637) 4 times on 3 different days in 2003. All encounters were about 2.5 km from the initial trap site. She was last seen on 30 March 2003 after a minimum 85 – day tenure. This bird may have used perches off the island to the west over the Laguna Madre. On 3 occasions I received weak signals from her transmitter to the west over the laguna while searching for falcons on SPI (Fig. 8).

I caught a juvenile female (#1807-52623) on 4 January 2003. I observed her on the north end of island in both the A and B sections on the wind – tidal flats and along the

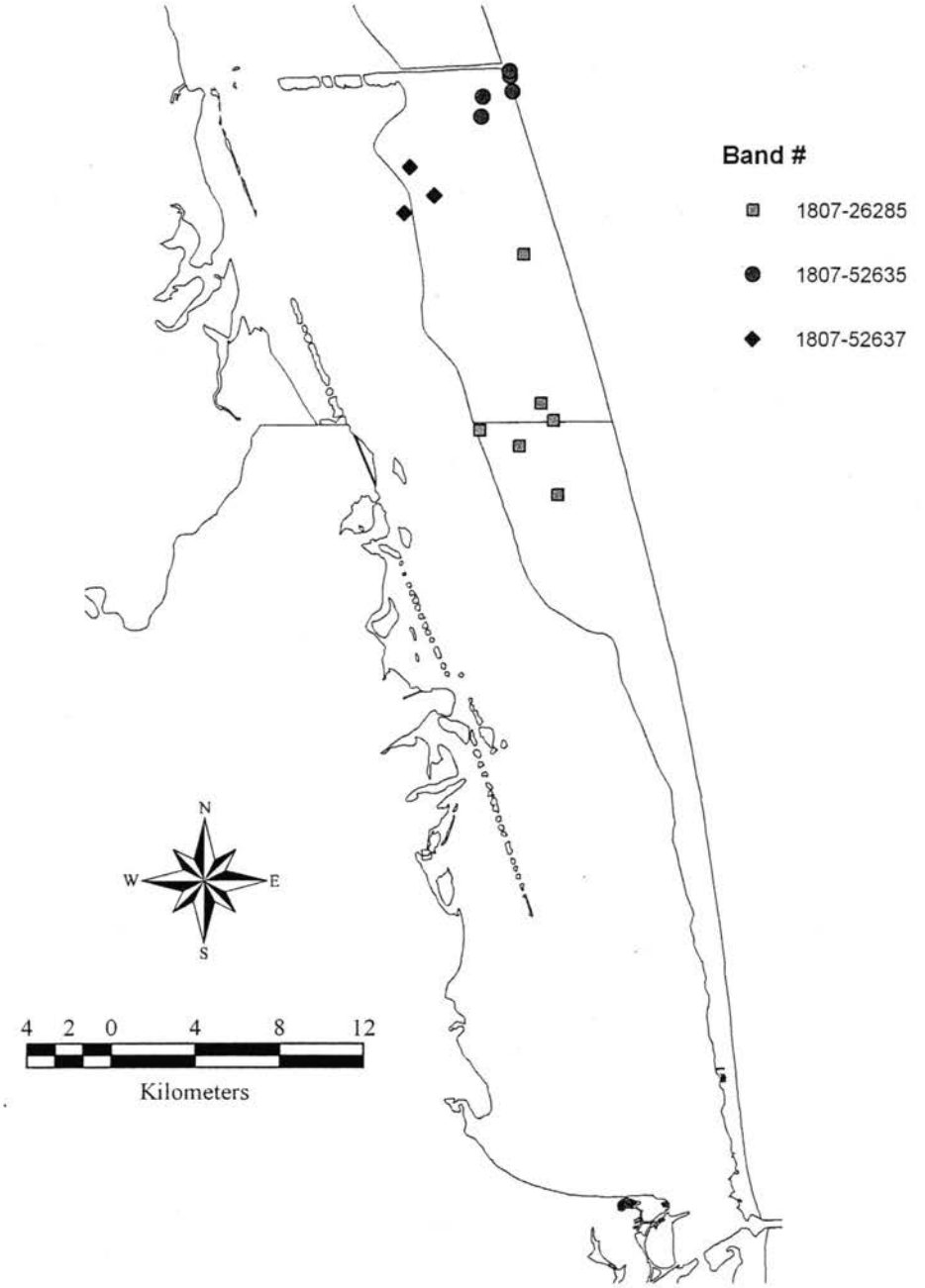

Figure 8. Locations of adult Peregrine Falcons on South Padre Island, Texas, in winter 2002 – 2003.

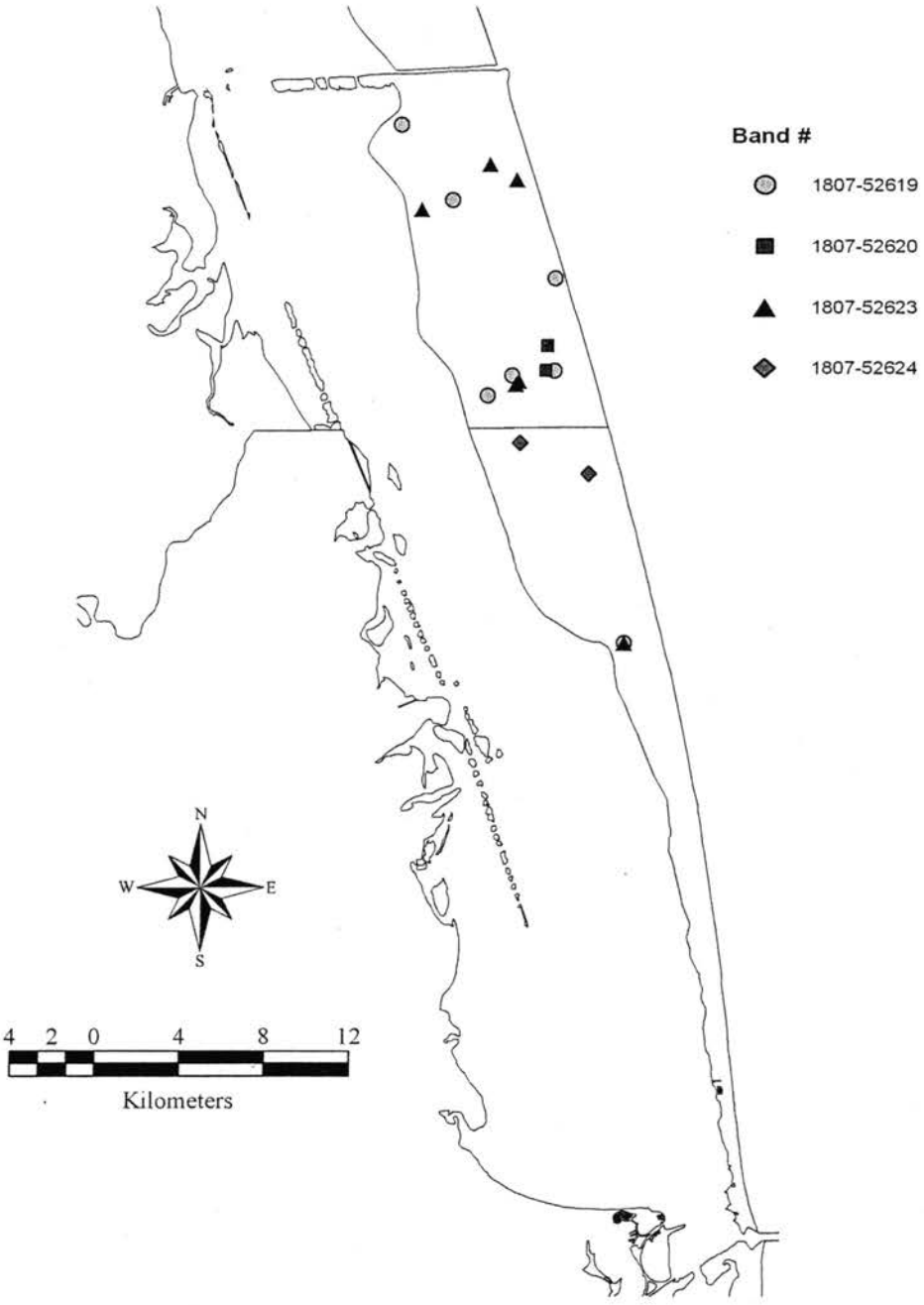

Figure 9. Locations of juvenile Peregrine Falcons on South Padre Island, Texas, in winter 2002 – 2003.

leeward side of the dunes. She did not exhibit a real affinity for a particular area or perch. She rarely was within 13 km of the previous encounter location. She was observed six times over an 85 – day period. The last encounter with this falcon was on 30 March 2003 (Fig. 9)

On 5 January 2003, I captured an adult female (#1807-26285). During her minimum 84 – day tenure, I encountered her 6 times with only 1 of those encounters over 4 km from her first capture site (Fig. 8).

A juvenile female (#1807-52624) caught on 19 January 2003 was only observed on 2 occasions that were 57 days apart, but the second encounter was about 4.6 km from the initial trap site (Fig. 9).

In 2002 – 2003, 4 falcons returned to SPI that were considered residents in 2001 – 2002 (Appendix 5). All 4 falcons were adult females in 2002 – 2003; however, 2 of these falcons (#1807-52635 and #1807-52637) were juveniles in 2001 – 2002. The 2002 fall migration was their first return to their wintering area on SPI and demonstrated their fidelity to the site.

Falcon #1807-52635 was away from SPI a maximum of 293 days, and her initial capture in 2002 – 2003 was only 0.83 km from the last encounter site in 2001 – 2002. A distance of 0.1 km was calculated between encounter locations on 16 February 2002 and approximately 1 year later on 17 February 2003 (Fig. 10)

I first encountered an adult female #1807-26285 in 2002 – 2003 only 2.6 km from the last observation site on 16 March 2002. She was gone from SPI a maximum of 295 days between the 2 seasons. I calculated a distance of 0.2 km between encounter locations on 2 March 2002 and 1 year later on 2 March 2003 (Fig. 10).

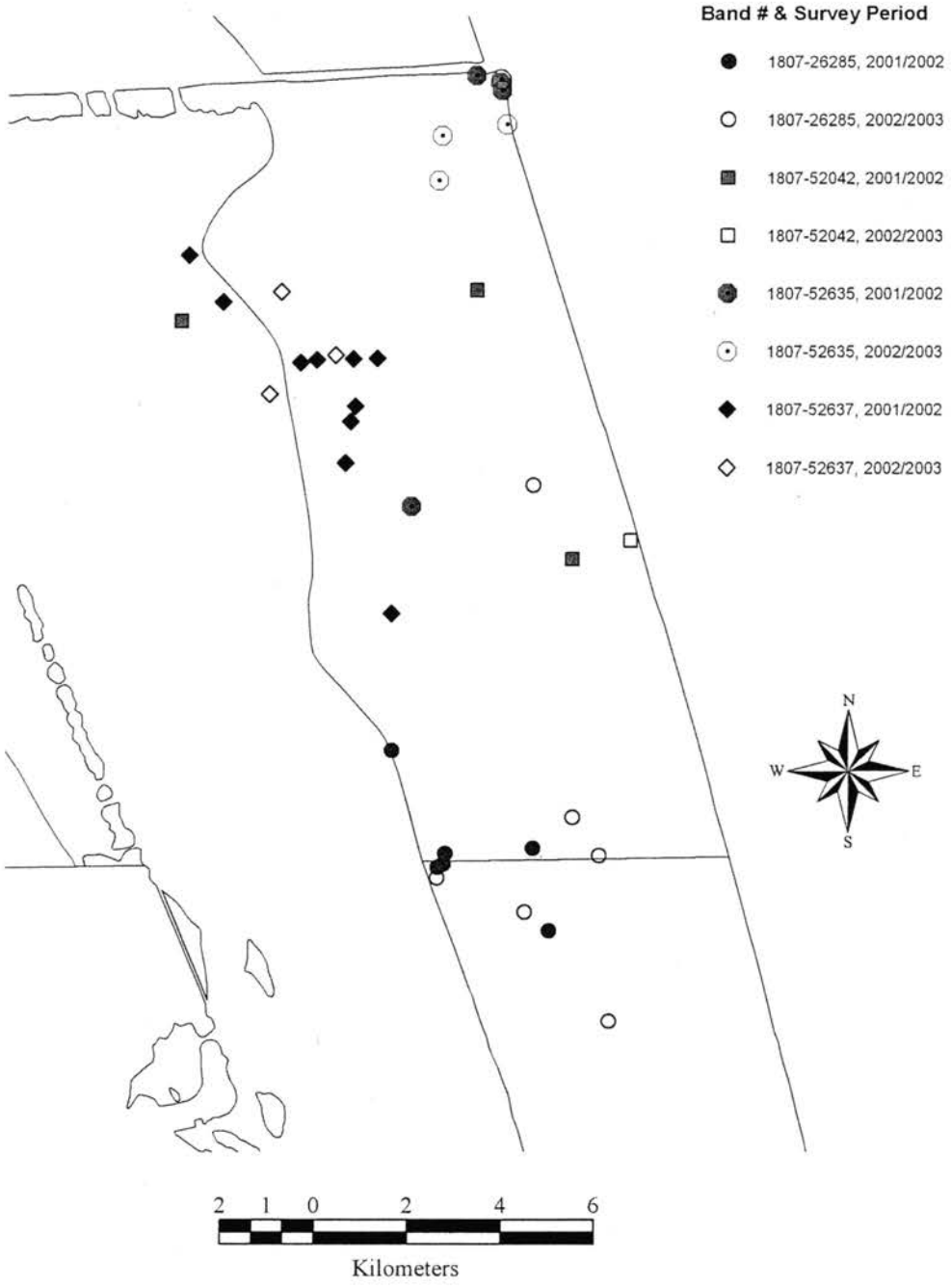

Figure 10. Locations of returning Peregrine Falcons on South Padre Island, Texas, in winters of 2001 – 2002 and 2002 – 2003.

The first year adult female #1807-52637, banded as a juvenile in 2002, was trapped on 4 January 2003 just 1.4 km from her last encounter location in 2002 (1 April). This falcon was gone from SPI a maximum of 278 days between the 2 seasons. I calculated a distance of 0.9 km between encounter locations on 17 February 2002 and 1 year later on 17 February 2003 (Fig. 10).

Although not considered a resident in 2002 – 2003, falcon #1807-52042, an adult female, was captured 362 days after her last observation on 2 February 2002. She was trapped only 1.6 km from her capture site in 2002 (6 January). Unfortunately, no other observations of this falcon occurred in 2002 – 2003 (Fig. 10).

Prey Use

I have knowledge of a total of 31 prey taken by peregrines during my study. Shorebirds represented 41.9% (n = 13) of the sample (Table 9). Laughing Gulls (*Larus atricilla*) composed 38.5% of shorebirds taken by falcons and 16.1% (n = 5) of the total sample. No other prey item exceeded the frequency of *L. atricilla* in the sample. Among land birds, White-winged Doves (*Zenaida asiatica*) (n = 2) and Horned Larks (*Eremophila alpestris*) (n = 2) were the most numerous. Land birds represented 29.03% (n = 9) of prey. Waterfowl (n = 3, 9.68%) were consumed the least. A Blue-wing Teal (*Anas discors*), a Lesser Scaup (*Aythya affinis*), and an unidentified duck composed waterfowl taken by peregrines. In addition, the group "Other" (Table 9, n = 6, 19.35%) was comprised of 5 unidentified birds and 1 unidentified insect.

Table 9. Species and number of prey by species comprising the diet of Peregrine Falcons on South Padre Island, Texas, during the winter 2001 – 2002 and 2002 – 2003 seasons

Species	Common Name	Number	Percentage
Shorebirds			
Larus atricilla	Laughing Gull	5	16.13
Larus delawarensis	Ring-billed Gull	2	6.45
Sterna maxima	Royal Tern	1	3.23
Egretta caerulea	Little Blue Heron	1	3.23
Larus sp.	Unidentified gull	2	6.45
Sterna sp.	Unidentified tern	1	3.23
Family: Scolopacidae	Unidentified sandpiper	1	3.23
Total shorebirds		**13**	**41.94**
Waterfowl			
Anas discors	Blue-wing Teal	1	3.23
Aythya affinis	Lesser Scaup	1	3.23
Family: Anatidae	Unidentified duck	1	3.23
Total waterfowl		**3**	**9.68**
Land birds			
Zenaida asiatica	White-winged Dove	2	6.45
Zenaida macroura	Mourning Dove	1	3.23
Eremophila alpestris	Horned Lark	2	6.45
Tachycineta bicolor	Tree Swallow	1	3.23
Vireo sp.	Unidentified vireo	1	3.23
Family: Parulidae	Unidentified warbler	1	3.23
Family: Hirundinidae	Unidentified swallow	1	3.23
Total land birds		**9**	**29.03**
Other			
Class: Aves	Unidentified bird	5	16.13
Class: Insecta	Unidentified insect	1	3.23
Total other		**6**	**19.35**
	TOTAL:	**31**	**100.00**

Summer Survey

I conducted 8 surveys during summer between 19 May 2002 and 4 August 2002 During that time period, I spent 50.5 hours searching for peregrines (6.3 hours per survey) I did not observe any falcons while conducting surveys nor noted any evidence of their presence on SPI during summer.

DISCUSSION

I observed a similar number of falcons for both seasons (Fig. 2 and 3), even though I modified my searching method in 2002 – 2003. The higher number of observations in 2001 – 2002 probably resulted from repeated observations of individuals because of the time spent searching for falcons. The number of falcons I saw using the island also was affected by climate and habitat issues By assigning a random schedule only to the sections (i.e , 2002 – 2003) rather than sections and transects within each section (i.e., 2001 – 2002), the total time I spent surveying was considerably less (44.5 hours) during 2002 – 2003. The reduced surveying time resulted in lower costs to conduct wintering peregrine surveys; therefore, continued monitoring and researching of this population in the future is possible.

Population Estimates

The population estimates for peregrines on SPI suggest a winter population of 7 to 9 individuals (Table 3, Fig. 4, Table 4, Fig. 5). The relatively large population estimate for 30 – 31 January 2003 most likely was a product of the model (Gould and Fuller 1995) and not an influx of birds into the SPI population. Furthermore, the large confidence intervals and relatively large standard error (SE = 5.7) for the 30 – 31 January 2003 estimate implied an inaccuracy in the estimate. The lower 95% confidence limit of 8.3 individuals probably was more indicative of the actual population. Also in agreement with the overall population estimate of 7 to 9 wintering peregrines, I observed 7 falcons

during the 30 – 31 January sample.

The population estimate for 2001 – 2002 (~ 7 individuals) was 1 bird less than my estimate for 2002 – 2003; even though, I observed and captured more falcons in 2001 – 2002. I attributed this difference to the possibility that in 2001 – 2002 a greater number of falcons may have occasionally used the island as foraging habitat but wintered off the island. This being the case, encounters with transients would not occur with the same regularity as with established winter residents. This point was illustrated by the number of falcons recaptured at least 1 time after banding (52.6% in 2001 – 2002 versus 57.1% in 2002 – 2003). The greater number of transient falcons in 2001 – 2002 may be explained by a more widespread distribution of prey resources throughout the Lower Laguna Madre in 2002 – 2003 because of late summer and autumn rains that filled inland lakes and lagunas. In 2001 – 2002, these lakes were dry and a falcon prey base was probably less or more localized than the prey base in 2002 – 2003. In addition, the lower number of winter residents in the first season could have been a result of increased territorial behavior for prime foraging areas on SPI (Newton 1979, Gerstell and Bednarz 1999). This stress would not have been an issue in 2002 – 2003.

Another interesting trend was the population increase in the last estimates for both seasons (Fig. 4 and 5), and the increase in observation rates near the end of both seasons (Fig. 1 and 2). These increases likely were an indication of the ensuing spring migration of peregrines on SPI, at most, 1 month before the spring migration peak, which occurs from 10 April to 3 May (T. Maechtle, per. comm.). I captured 2 winter resident falcons in 2001 – 2002 after 1 March. I encountered them during every survey for the remainder of that season. Both birds were in their 12th year (i.e., 11 years old at the time of capture)

and in good health. Hunt and Ward (1988) found the Gulf Coast of Mexico and the U.S was particularly important as a staging area for migrating Peregrine Falcons. These particular falcons may have been early northward migrants that stopped at SPI for staging purposes. Unfortunately in 2002 – 2003, I was unable to document this early staging of falcons on SPI.

Enderson et al. (1995) provided a very conservative population estimate of 20 individuals inland of the beaches on SPI in 1994, and a density of 1 falcon per 50 km^2 in their 1,000 km^2 study area, which included the Laguna Madre and parts of the mainland. I am hesitant to provide an estimate like this for SPI alone, considering that the overall area of the island constantly changed because of inundation from the Laguna Madre and from frequent rainfall. Any estimate of the density would be a crude estimate and should be treated as anecdotal information given the inconsistencies in the amount of dry land available on the wind – tidal flats at a given time However, adequate perching sites were available to falcons on parts of the wind – tidal flats during inundation, in which case an estimate may be acceptable. On SPI, I estimated about 1 falcon per 28 km^2 in an estimated 200 km^2 survey area. My estimated density compared to estimates by Enderson et al. (1995) was larger. They differ because a large part of their study area encompassed the laguna, where a lower density of falcons may occur, and thus, affect the overall density as compared to SPI alone.

Population Demographics

Female falcons composed the majority of the population on SPI in both seasons. There was no detectable difference between the number of juveniles and adults.

Unbalanced sex ratios are not uncommon in peregrines during migration (Ward and Berry 1972, Hunt et al. 1975). Moreover, White et al. (1989) observed similar situations in North American subspecies of peregrines during winter in coastal habitats of Colombia, Ecuador, and Peru. Enderson et al. (1991) identified a preponderance of adult female falcons near Culiacan, Sinaloa, Mexico Furthermore, the results of a study of wintering peregrines conducted about 200 km south of SPI on the Gulf Coast of Tamaulipas, Mexico, showed most falcons were also adult females (McGrady et al 2002). One possible explanation for skewed sex ratios favoring females in the population is spatial habitat partitioning between sexes (Newton 1979, Temeles 1986, White et al 1989). To help explain this phenomenon, Restani and Mattox (2000) found male Peregrine Falcons banded as nestlings in Greenland often wintered in South America, while females wintered to the north in Central America and the Caribbean.

My results reflected skewed sex ratios similar to those seen in falcons in Sinaloa and Tamaulipas. However, 1 difference existed within the female component of the population involving age ratios. I found no difference in the number of adult and juvenile female falcons wintering in either season on SPI, which conflicted with the findings of Enderson et al (1991) and McGrady et al. (2002). The greater occurrence of juvenile birds on SPI than in Sinaloa and Tamaulipas more closely resembled the age ratios observed during the autumn peregrine migration, where a greater number of immature than adult falcons were encountered (Rogers and Hunt 1975, Hunt et al. 1975). The reason for the differences within age classes observed on SPI compared to other studies is not known, especially for costal Tamaulipas, which is also part of the Laguna Madre

system. Overall, SPI appears to be an important wintering area for female Peregrine Falcons.

Habitat Use

Habitat use by peregrines on SPI was not consistent in both seasons. In 2001 – 2002, falcons used the wind – tidal flats in greater proportion than the vegetated barrier flats and beach (Table 5). Dobler and Spencer (1989) found wintering peregrines in Washington extensively used tidal mudflats. When tides receded, the mudflats attracted large flocks of shorebirds, which the falcons preyed upon. A similar situation existed on SPI with regards to concentrations of shorebirds on the wind – tidal flats and was a likely explanation for the greater number of observations on the western most transects paralleling the waterline of the Laguna Madre. The wind – tidal flats of SPI provided the falcons with a vast and featureless habitat with little escape cover for the falcon's prey. Undoubtedly, this situation provided the falcons a tremendous advantage for procuring food during winter.

The peregrine habitat use during 2001 – 2002 was comparable to that reported by Hunt and Ward (1988), where spring migrant peregrines favored wind – tidal flats in 1980, but a greater number occurred in the dune area (i.e., vegetated barrier flat) in 1979. In 2002 – 2003, I observed falcons evenly distributed across the 4 transects with a notable increase (+15.47%) compared to 2001 – 2002 in the percent occurrence of falcons on #3 transects (i.e., west edge of the vegetated barrier flat or dune area) (Table 7). This increased usage of the vegetated barrier flat compared to 2001 – 2002 likely was related to the presence of many wind deflation troughs along the island on the leeward side of the

fore – island dune ridge containing fresh water, which prey species like dove, waterfowl, and other birds used as a fresh water source These ephemeral dune lakes were filled by rainfall earlier in 2002 and were not as numerous during 2001 – 2002. The falcons likely responded to a greater abundance of prey at these dune lakes; although, I have no quantitative data to support this theory. Hunt and Ward (1988) suggested falcons in 1979 used the dune areas in response to an increased abundance of prey at these dune lakes, which were not available in 1980 Despite the increased use of the vegetated barrier flats in 2002 – 2003, the wind – tidal flats still had the greatest use by falcons and seem to be the most used of all the habitats on SPI Additionally, I attributed the lack of observations of falcons on the beach, especially on the southern end of the island in both seasons (Tables 6 and 8), to disturbance of resident falcons by automobile traffic and fishermen on the beach throughout winter.

Site Fidelity

Within year site fidelity was common in many falcons wintering on SPI in both seasons. Individuals frequently used the same perches throughout the winter and certainly remained in distinct areas on the island (Fig. 6, 7, 8, and 9, Appendices 3 and 4). Similarly, Schueck et al. (1995) found adult Golden Eagles (*Aquila chrysaetos*) showed fidelity to areas in the winter, and Plumpton and Andersen (1997) determined that wintering Ferruginous Hawks (*Buteo regalis*) in Colorado remained in geographic areas and even specific habitats for long periods in winter. Wintering Prairie Falcons (*Falco mexicanus*) in northern Colorado also exhibited fidelity for given areas in winter. The Prairie Falcons' (n = 6) average duration of residency in the 1960 – 61 was 58 days

(Enderson 1964). Likewise, the average tenure observed in wintering Peregrine Falcons (n = 13) on SPI in both seasons was 67 days; however, 8 of 13 residents present during the last survey periods could have remained on the island throughout spring migration to as late as 19 May in 2002 (see Summer Survey). Additionally, falcons captured during the first 2 sample periods could have been established as early as September or October similar to wintering falcons in Tamaulipas, Mexico (McGrady et al. 2002). Several falcons on SPI in both seasons remained in areas close to their capture site or close to the second encounter site McGrady et al. (2002) found centers of activity for peregrines fitted with backpack – mounted, satellite – received transmitters (PTTs) near their respective capture sites throughout winter on the coast of Tamaulipas. This strong tenacity for individuals to remain on SPI and even in specific areas on the island was likely a result of territorial behavior. Enderson et al. (1995) recorded 6 instances in which adult peregrines attacked conspecifics resulting in the attacked bird leaving the area and suggested that adult falcons may indeed be territorial in winter. I made 1 observation in 2001 – 2002 of a juvenile falcon attacking another juvenile, but I was unable to determine the outcome of the encounter. Unfortunately, no other observations of territorial behavior were made during the course of my study; however, the lack of territoriality observations was linked to the absence of continued observation of individuals throughout the day, which was not in the scope of my study.

Year to year site fidelity for specific nesting sites is common in breeding falcons (Enderson 1964, Tordoff and Redig 1997) and other raptors (Newton 1979); however, between year fidelity for wintering areas also has been documented in warblers (Faaborg and Arendt 1984), American Tree Sparrows (*Spizella arborea*) (Brooks 1985), Northern

Shrikes (*Lanius excubitor*) (Rimmer and Darmstadt 1996), Rough-legged Hawks (*Buteo lagopus*) (Garrison and Bloom 1993), Bald Eagles (*Haliaeetus leucocephalus*) (Harmata and Stahlecker 1993), Ferruginous Hawks (Plumpton and Andersen 1997), Sharp-shinned Hawks (*Accipiter striatus*) (Powers 1996), Prairie Falcons (Enderson 1964), and Peregrine Falcons (McGrady et al. 2002). On SPI, I documented year to year site fidelity in 4 peregrines (Fig. 10 and Appendix 5). Interestingly, 3 of 4 falcons were captured in the second year within 2.7 km of the last encounter site in 2001 – 2002 and even used the same perches as in the previous season. Furthermore, the forth falcon was captured about 1.6 km from her initial capture site in 2002. The behavior of these 4 falcons strongly supports the theory (McGrady et al. 2002) that peregrines are faithful to territories occupied in previous winters. One falcon (#1807-26285) that wintered on SPI in both seasons was first banded on SPI in April 1994 as a second – year bird. She could have spent her first winter on SPI in 1993 – 1994. If this particular falcon remained faithful to SPI every winter, she would have wintered on the island for 10 consecutive years. This scenario is quite possible as two 2001 – 2002 juvenile falcons (#1807-52635 and #1807-52637) were recaptured as first – year adults in 2002 – 2003 and showed strong site fidelity in both seasons. Site fidelity could likely be an important strategy for surviving the non-breeding season (Rimmer and Darmstadt 1996) and most likely is affected by the abundance of prey and/or availability of perch sites (Newton 1979, Johnsgard 1990, Garrison and Bloom 1993).

Prey Use

The majority of prey eaten by peregrines consisted of shorebirds, primarily gulls (*Larus* sp.). Bent (1961: 63) described a peregrine near Tampa Bay, Florida, "I occasionally saw it sitting on some little eminence on the islands frequented by terns and various shorebirds. A picked skeleton of a royal tern and the remains of gulls and shorebirds were evidences of its work." Withers (2002) found large numbers of shorebirds, mainly in the genus *Caladris*, foraged on invertebrates on wind – tidal flats of the Laguna Madre in winter because invertebrates were more abundant during winter. Although, I only observed 1 sample of a shorebird (Family: Scolopacidae) during my work on SPI; undoubtedly, shorebirds in this family represent an important prey base for wintering peregrines on SPI. My lack of finding *Caladris* remains on the island was probably related to the total consumption of these shorebirds by falcons as opposed to a lack of total consumption of the larger gulls and wading birds identified as prey. My identification of parts of smaller shorebirds in castings was difficult. A closer examination of winter food habits of peregrines on SPI might likely reveal many of the smaller shorebird species comprise a larger portion of the falcons' diet.

Summer Survey

I did not find Peregrine Falcons during the summer of 2002 and confounded speculations that yearling falcons spend their first summer on SPI (Enderson et al. 1995). Falcons likely are absent from the island by 10 May and certainly by 19 May. Hunt et al. (1981) documented departures of radiotagged peregrines from 19 April to 7 May. Given

this information, I concluded that Peregrine Falcons are not present on SPI during summer at least between 19 May to 4 August.

Management Implications

The importance of wintering areas for raptors in North America has been acknowledged (Garrison and Bloom 1993, Plumpton and Andersen 1997, McGrady et al 2002) and conservation of these habitats is vital for maintaining a healthy breeding population This is especially true for peregrines, specifically *F. p. tundrıs*, because much of their lives are spent away from their breeding areas on migration and in wintering habitat (McGrady et al. 2002). Given the lack of knowledge of peregrine ecology outside their breeding grounds, where their survival greatly may be affected (Iñigo and Dominguez 1989), and the level of tenacity exhibited in peregrines for wintering areas (McGrady et al. 2002), more research is needed to understand the ecology of this species in non-breeding areas to allow informed and appropriate conservation decisions in the future.

One study that could augment the information on wintering Peregrine Falcons on SPI might include an in depth food habits study to elucidate their winter diet and to determine the influence of prey resources on falcon habitat use. Also, studies documenting intraspecific interactions in peregrines might help explain the extent of site fidelity observed on SPI. Research pertaining to nocturnal activities in wintering peregrines and the importance of perch/roost availability and selection would be of interest because many falcons appear to roost on the open sand and may be susceptible to predation by coyotes (*Canis latrans*). Identifying limiting factors on this population also

would be of interest. Most importantly, continued monitoring of this population could identify long – term site fidelity in individuals, potential changes or stability in the population, and conservation actions needed to preserve coastal resources to avoid deleterious effects to the falcon population.

LITERATURE CITED

Beebe, F. L. and H. M. Webster. 2000 North American falconry and hunting hawks. North American Falconry and Hunting Hawks. Fort Benton, MT. 475 pp

Bent, A. C. 1961. Life histories of North American birds of prey: Part 2. Dover Publications, Inc., New York. 482 pp.

Brooks, E. W. 1985. Fidelity of an American tree sparrow. Journal of Field Ornithology 56: 406-407.

Brown, L. F., Jr., J. L. Brewton, T. J. Evans, J. H. McGowen, W. A. White, C. G. Groat, and W. L Fisher. 1980. Environmental geologic atlas of the Texas coastal zone: Brownsville – Harlingen area. Bureau of Economic Geology, University of Texas, Austin, TX. 140 pp.

Cade, T. J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. University of California Publication in Zoology 63: 151-290.

Court, G. S., C. C. Gates, and D. A. Boag. 1988. Natural history of the Peregrine Falcon in the Keewatin District of the Northwest Territories. Arctic 41: 17-30.

Dobler, F. C. 1993. Wintering peregrine falcon (*Falco peregrinus*) habitat utilization near Sequim, Washington. Northwest Science 67: 231-237.

Dobler, F. C. and R. D. Spencer. 1989 Wintering peregrine falcon (*Falco peregrinus*) habitat utilization in Grays Harbor, Washington Pp. 71-78 *in* B. -U. Meyburg and R. D. Chancellor [Eds.], Raptors in the Modern World. World Working Group on Birds of Prey, Berlin.

Dunstan, T C. 1973. Tail feather package for radio-tagging raptorial birds. Inland Bird Banding News 45(1) 3-6.

Enderson, J. H 1964. A study of the prairie falcon in the Central Rocky Mountain Region. Auk 81: 332-352.

———— 1965. A breeding and migration survey of the peregrine falcon. Wilson Bulletin 77: 327-339

Enderson, J. H., C. Flatten, and J. P. Jenny. 1991. Peregrine falcons and merlins in Sinaloa, Mexico, in winter. Journal of Raptor Research 25: 123-126.

Enderson, J. H., J. Larrabee, Z. Jones, C. Peper, and C. Lepisto. 1995. Behavior of peregrines in winter in south Texas. Journal of Raptor Research 29: 93-98

Faaborg, J. and W. J. Arendt. 1984. Population sizes and philopatry of winter resident warblers in Puerto Rico. Journal of Field Ornithology 55· 376-378.

Garrison, B. A. and P. H. Bloom. 1993 Natal origins and winter site fidelity of rough-legged hawks wintering in California. Journal of Raptor Research 27. 116-118.

Gerstell, A. T. and J. C. Bednarz. 1999. Competition and patterns of resource use by two sympatric raptors. The Condor 101: 557-565.

Gould, W. R. and M. R. Fuller 1995 Survival and population size estimation in raptor studies: A comparison of two methods. Journal of Raptor Research 29: 256-264.

Griscom, L. and M. S. Crosby. 1925. Birds of the Brownsville region, southern Texas. Auk 42: 519-537.

Harmata, A. R. and D. W. Stahlecker. 1993 Fidelity of migrant bald eagles to wintering grounds in Southern Colorado and Northern New Mexico. Journal of Field Ornithology 64(2): 129-292.

Hunt, W. G. and R. Rogers. 1973. Texas peregrine falcons. Texas Ornithological Society 6: 14-16.

Hunt, W. G. and F. P. Ward. 1988. Habitat selection by spring migrant peregrines at Padre Island, Texas. Pp. 527-535 *in* T. J. Cade, J. H. Enderson, C. G. Thelander, and C. M. White [Eds.], Peregrine falcon populations: their management and recovery. The Peregrine Fund, Inc., Boise, ID, U.S.A.

Hunt, W. G., R. R. Rogers, and D. J Slowe. 1975. Migratory and foraging behavior of peregrine falcons on the Texas coast. Canadian Field-Naturalist 89 (2): 111-123.

Hunt, W. G., F. P. Ward, and B. S Johnson. 1981. Peregrine falcon migrations: continuing studies. Report to Department of Defense, Aberdeen Proving Ground, MD. Contract No. DAADO-81-C-0095 43 pp

Iñigo, E. and R. Dominguez. 1989. Threats to raptors during the migration and non-breeding season in Mexico. Pp. 59-60 *in* B. -U. Meyburg and R. D. Chancellor [Eds.], Raptors in the modern world. World Working Group on Birds of Prey, Berlin.

Johnsgard, P. A. 1990. Hawks, eagles, and falcons of North America: biology and natural history. Smithsonian Institution Press. Washington, D.C. 403 pp.

Krebs, C. J. 1999. Ecological methodology. Addison-Wesley Publisher. Menlo Park, CA. 620 pp.

Marti, C. D. 1987. Raptor food habits studies. Pp. 67-77 *in* B. A. Giron Pendleton, B A. Millsap, K. W. Cline, and D. M. Bird, eds. Raptor management techniques manual. National Wildlife Federation, Washington, D C.

Maechtle, T. L. 1998. The Aba: a device for restraining raptors and other large birds. Journal of Field Ornithology 69: 66-70

McGrady, M J., T. L. Maechtle, J. J. Vargas, W S. Seegar, and M. Catalina Porras Peña 2002. Migration and ranking of peregrine falcons wintering on the Gulf of Mexico Coast, Tamaulipas, Mexico The Condor 104· 39-48.

Mills, G. S. 1975. A winter population study of the American kestrel in central Ohio. Wilson Bulletin 87: 241-247.

Newton, I. 1979. Population ecology of raptors. Buteo Books. Vermillion, SD. 399 pp.

Palmer, R. S. 1988. Handbook of North American birds. Vol. 5. Yale University Press. New Haven, CT. 465 pp.

Plumpton, D. L. and D. E. Andersen. 1997. Habitat use and time budgeting by wintering ferruginous hawks. The Condor 99: 888-893.

Powers, L. R. 1996. Wintering sharp-shinned hawks (*Accipiter striatus*) in an urban area of southwestern Idaho. Northwestern Naturalist 77: 9-13.

Quinn, G. P. and M. J Keough. 2002. Experimental design and data analysis for biologists. Cambridge University Press. Cambridge, U.K. 537 pp.

Ratcliffe, D. 1993. The Peregrine Falcon. 2nd ed. T and A. D. Poyser, London. 454 pp.

Restani, M. and W. G. Mattox. 2000. Natal dispersal of peregrine falcons in Greenland. Auk 117: 500-504.

Rimmer, C. C. and C. H. Darmstadt. 1996. Non-breeding site fidelity in northern shrikes. Journal of Field Ornithology 67: 360-366.

Rogers, R. R. and G. Hunt. 1975. Peregrines on South Padre Island: Recent years. Pp. 61-65 *in* J. R. Murphy, C. M. White and B. E. Harrell [Eds.] Population status of raptors. Raptor Research Foundation, Inc. Vermillion, SD. Raptor Research Report No. 3. (Proceedings of the conf. on raptor conservation techniques, Fort Collins CO. March 22-24, 1973 (Part 6))

Samuel, M. D , and M. R. Fuller 1994. Wildlife radiotelemetry. Pp. 370-418 *in* T. A. Bookhoust, ed. Research and management techniques for wildlife and habitats Fifth ed. The Wildlife Society. Bathesda, MD

Schueck, L. S., J. M. Marzluff, and M. Vekasy. 1995. Abstract: Migration routes and winter ranges of golden eagles. Journal of Raptor Research 29: 72-73.

Temeles, E. J. 1986. Reversed sexual size dimorphism: Effect on resource defense and foraging behaviors of nonbreeding Northern Harriers. The Auk 103: 70-78.

Tordoff, H. B. and P. T. Redig. 1997. Midwest peregrine falcon demography, 1982 – 1995. Journal of Raptor Research 31. 339-346

Ward, F. P. and R. B. Berry. 1972. Autumn migrations of peregrine falcons on Assateague Island, 1970-71. Journal of Wildlife Management 36: 484-492.

White, C. M., R. W. Risenbrough, and S. A. Temple. 1989. Observations of North American breeding peregrines *Falco peregrinus* on the non-breeding grounds in South America. Pp. 89-93 *in* B. -U. Meyburg and R. D. Chancellor [Eds.], Raptors in the Modern World. World Working Group on Birds of Prey, Berlin.

Withers, K. 2002. Shorebirds and wading birds Pp. 198-210 *in* J. W. Tunnell, Jr. and F. W. Judd [Eds.], The Laguna Madre of Texas and Tamaulipas. Texas A & M University Press, College Station.

Yates, M. A., K. E. Riddle, and F. P. Ward. 1988. Recoveries of peregrine falcons migrating through the eastern and central United States, 1955-1985. Pp. 471-483 *in* T. J. Cade, J. H. Enderson, C. G. Thelander, and C. M. White [Eds.], Peregrine falcon populations: their management and recovery. The Peregrine Fund, Inc , Boise, ID, U.S.A.

APPENDICES

Appendix 1 General information on Peregrine Falcons captured on South Padre Island, Texas, during 2001 - 2002 Note: Age codes are as follows HY = hatch year, SY = second year, and ASY = after second year

#	Date	Time	Age	Sex	Weight (g)	Wing Cord (mm)	USFWS Band #	Leg	Transmitter Frequency	Comments
1	12/09/01	940	HY	F	1020	365	1807-86394	R	150 316	
2	12/09/01	1256	ASY	F	990	350	1807-51900			25% crop
3	12/10/01	850	ASY	M	600	315	816-64045	L	150 845	
4	12/13/01	1115	HY	F	1050	350	1807-52631	L		30% crop - eating *Larus atricilla* *F p anatum*
5	12/20/02	1145	SY	F	950	358	1807-52632	L	150 224	
6	12/21/02	920	HY	F	930	368	1807-52633	L	150 433	
7	12/22/02	1038	HY	F	830	354	1807-52634	L	150 505	25% crop
8	12/23/02	1140	HY	F	865	346	1807-52635	L	150 615	25% crop - feeding on juv *L delawarensis* w/ 1807-86394
9	01/04/02	915	SY	F	815	359	1807-52636	L	150 719	
10	01/04/02	1215	ASY	F	1040	350	1807-26285	L	150 036	10% crop
11	01/06/02	1058	SY	F	905	370	1807-52637	L		Feeding on *Zenaida macroura*, no sizeable crop
12	01/06/02	1732	ASY	F	1105	335	1807-52042	R	150 125	30% crop
13	01/18/02	1120	SY	F	830	364	1807-86361	R		
14	01/19/02	1220	ASY	F	940	356	1807-52638	L	150 355	
15	02/02/02	1058	ASY	F	905	340	1807-86278	L	150 425	
16	02/17/02	1747	SY	F	762	359	1807-52639	L		Left wing stained black by crude / oil or the like
17	03/02/02	1055	ASY	F	960	344	1807-20836	L	150 586	12yr old
18	03/16/02	1528	ASY	F	980	357	1807-20986	L	150 095	12 yr old
19	03/17/02	1054	ASY	F	970	375	1807-86280	L		*F p anatum*
20	03/17/02	1115	ASY	M	720	314	220628930	R		VID Black L over Green G on Left - *F p anatum*
21	03/31/02	730	ASY	F	850	358	1807-86279	L		

Appendix 2 General information on Peregrine Falcons captured on South Padre Island, Texas, during 2002 - 2003 Note Age codes are as follows HY = hatch year, SY = second year, and ASY = after second year

#	Date	Time	Age	Sex	Weight (g)	Wing Cord (mm)	USFWS Band #	Leg	Transmitter Frequency	Comments
1	12/21/02	846	HY	F	980	356	1807-52617	L		
2	12/22/02	920	SY	F	940	348	1807-52635	L	150 496	
3	12/22/02	1125	HY	F	1050	365	1807-52619	L	150 077	80% Crop
4	12/22/02	1126	HY	F	1070	368	1807-52618	L		25% Crop
5	12/22/02	1603	HY	F	1080	376	1807-52620	L		
6	12/22/02	1735	HY	F	1160	357	1807-52621	L		75% Crop, Feathers damp
7	01/04/03	958	SY	F	1220	367	1807-52622	L		30% Crop
8	01/04/03	1428	ASY	F	970	365	1807-52637	L	150 676	#10 Primaries still in blood
9	01/04/03	1717	SY	F	1050	369	1807-52623	L	150 767	
10	01/19/03	1150	ASY	F	1110	350	1807-26285	L	150 445	90% Crop, 9 yr old
11	01/19/03	1315	SY	F	920	353	1807-52624	L		
12	01/30/03	1031	ASY	F	1070	355	1807-52042	R	150 175	75% Crop
13	01/30/03	1603	SY	F	1020	359	1807-52625	L		95% Crop
14	03/01/03	746	ASY	F	1060	N/A	1807-13313	L		R lg Blk Metal L (side) over 4, Well worn, Touch sharp
15	03/01/03	1417	SY	F	960	366	1807-52626	L		Touch sharp
16	03/30/03	1342	SY	F	990	359	1807-52627	L		25 % Crop

Appendix 3 Site fidelity data for Peregrine Falcons observed in winter 2001 - 2002 on South Padre Island, Texas

Bird Band #	Date	Time	Age**	Sex	Distance From Initial Encounter (km)	Days Since Initial Capture	Distance Since Last Encounter (km)	Days Since Last Encounter
1807-86394	12/09/01	940	HY	F				
	12/23/01	1102			13 854	14		
	01/04/02	1450	SY		4 655	26	13 345	12
	01/06/02	1605			6 183	28	5 674	2
1807-51900	12/09/01	1256	ASY	F				
816-64045	12/10/01	850	ASY	M				
	02/17/02	1430			30 725	69		
	03/14/02	1603			14 759	94	45 484	25
	03/17/02	700			9 354	97	7 999	3
1807-52631	12/13/01	1115	HY	F				
1807-52632	12/20/02	1145	SY	F				
1807-52633	12/21/02	920	HY	F				
1807-52634	12/22/01	1038	HY	F				
	01/05/02	938	SY		11 463	14		
1807-52635	12/23/01	1140	HY	F				
	01/06/02	905	SY		10 512	14		
	02/02/02	1610			10 759	41	0 871	27
	02/16/02	1548			10.88	55	0 209	14
	03/04/02	1115			10 759	71	0 209	16
1807-52636	01/04/02	915	SY	F				
	01/05/02	825			6 509	1		
1807-26285	01/04/02	1215	ASY	F				
	01/20/02	1445			2 249	16		
	02/03/02	1550			0 259	30	1 99	14
	02/17/02	1316			3 533	44	3 342	14
	03/02/02	925			0 192	57	3 485	13
	03/16/02	740			3 696	71	3 744	14
1807-52637	01/06/02	1058	SY	F				
	02/03/02	1206			5 186	28		
	02/16/02	1300			6.772	41	11.958	13
	02/16/02	1820			1.048	41	5 724	0
	02/17/02	745			2 101	42	1 201	1
	03/01/02	1507			1 402	54	3 095	12
	03/03/02	1812			0.416	56	0 986	2
	03/04/02	1008			1 805	57	2 029	1
	03/21/02	1730			1 484	74	1 317	17
	04/01/02	1235			5 042	85	4 494	11
1807-52042	01/06/02	1732	ASY	F				
	02/02/02	1447			7 785	27		
	02/02/02	1800			13.432	27	6.977	0
1807-86361	01/18/02	1120	SY	F				
1807-52638	01/19/02	1220	ASY	F				
1807-86278	02/02/02	1058	ASY	F				
1807-52639	02/17/02	1747	SY	F				
	03/16/02	1722			3 298	27		
	03/31/02	1433			0 676	42	3 584	15
1807-20836	03/02/02	1055	ASY	F				
	03/03/02	1812			21 683	1		
	03/16/02	1023			2 411	14	19 272	13
	04/01/02	830			1 813	30	0 782	16
1807-20986	03/16/02	1528	ASY	F				
	03/22/02	1140			8 621	6		
	04/01/02	1623			0 139	16	8 512	10
1807-86280	03/17/02	1054	ASY	F				
220628930	03/17/02	1115	ASY	M				
1807-86279	03/31/02	730	ASY	F				

** Note on age codes HY = hatch year; SY = second year; ASY = after second year

Appendix 4 Site fidelity data for Peregrine Falcons observed in winter 2002 - 2003 on South Padre Island, Texas.

Bird Band #	Date	Time	Age**	Sex	Distance From Initial Encounter (km)	Days Since Initial Capture	Distance Since Last Encounter (km)	Days Since Last Encounter
1807-52617	12/21/02	846	HY	F				
1807-52635	12/22/02	920	SY	F				
	01/04/03	1240	ASY		2 659	13		
	01/31/03	1609			0 825	40	3 268	27
	02/17/03	907			1 07	57	0 245	17
	03/16/03	1436			1 081	84	0 011	27
	03/30/03	940			1 635	98	2.462	14
1807-52619	12/22/02	1125	HY	F				
	01/05/03	830	SY		14 401	14		
	01/18/03	1511			16 965	27	6 566	13
	01/30/03	1427			18 708	39	2 217	12
	01/31/03	1243			34 801	40	16 093	1
	03/02/03	1446			16 738	70	18 063	30
	03/16/03	1620			5 919	84	10 819	14
1807-52618	12/22/02	1126	HY	F				
1807-52620	12/22/02	1603	HY	F				
	03/30/03	1619			1 204	98		
1807-52621	12/22/02	1735	HY	F				
1807-52622	01/04/03	958	SY	F				
1807-52637	01/04/03	1428	ASY	F				
	02/17/03	1201			2 513	44		
	02/17/03	1317			2 513	44	0	0
	03/30/03	1315			2 418	85	2.235	41
1807-52623	01/04/03	1717	SY	F				
	01/18/03	1510			9 586	14		
	01/31/03	1243			26 841	27	17.261	13
	01/31/03	1809			1 97	27	28 811	0
	03/16/03	1815			5 875	71	5 349	44
	03/30/03	1514			9 552	85	12 603	14
1807-26285	01/05/03	1048	ASY	F				
	01/19/03	1150			2 797	14		
	02/16/03	1653			3 759	42	4 142	28
	02/17/03	1240			9 331	43	13 09	1
	03/02/03	1422			3 933	56	10 38	13
	03/30/03	1619			1.393	84	4 172	28
1807-52624	01/19/03	1315	SY	F				
	03/17/03	1535			4 686	57		
1807-52042	01/30/03	1031	ASY	F				
1807-52625	01/30/03	1603	SY	F				
1807-13313	03/01/03	746	ASY	F				
	03/01/03	1206			1 278	0		
1807-52626	03/01/03	1417	SY	F				
1807-52627	03/30/03	1342	SY	F				

** Note on age codes HY = hatch year; SY = second year; ASY = after second year

Appendix 5 Site fidelity data for Peregrine Falcons observed in both the 2001 - 2002 and 2002 - 2003 winter seasons on South Padre Island, Texas Note Between season calculations are in **bold**

Bird Band #		Date	Time	Age**	Sex	Distance From Initial Encounter (km)	Days Since Initial Capture	Distance Since Last Encounter (km)	Days Since Last Encounter
1807-52635		12/23/01	1140	HY	F				
		01/06/02	905	SY		10 512	14		
		02/02/02	1610			10 759	41	0 871	27
	*	02/16/02	1548			10 88	55	0 209	14
		03/04/02	1115			10 759	71	0 209	16
		12/22/02	920			**10.15**	**364**	**0.825**	**293**
		01/04/03	1240	ASY		**7.491**	**377**	2 659	13
		01/31/03	1609			**10.759**	**404**	3 268	27
	*	02/17/03	907			**10.978**	**421**	0 245	17
		03/16/03	1436			**10.977**	**448**	0 011	27
		03/30/03	940			**8.515**	**462**	2 462	14
*** Distance between 2001/2002 & 2002/2003 Frequented Locales**								**0.098**	
1807-26285		01/04/02	1215	ASY	F				
		01/20/02	1445			2 249	16		
		02/03/02	1550			0 259	30	1 99	14
		02/17/02	1316			3 533	44	3 342	14
	*	03/02/02	925			0 192	57	3 485	13
		03/16/02	740			3 696	71	3 744	14
		01/05/03	1048			**3.513**	**366**	**2.681**	**295**
		01/19/03	1150			**2.772**	**380**	2 797	14
		02/16/03	1653			**6.914**	**408**	4 142	28
		02/17/03	1240			**9.96**	**409**	13 09	1
	*	03/02/03	1422			**0.42**	**422**	10 38	13
		03/30/03	1619			**3.752**	**450**	4 172	28
*** Distance between 2001/2002 & 2002/2003 Frequented Locales**								**0.228**	
1807-52637		01/06/02	1058	SY	F				
		02/03/02	1206			5 186	28		
		02/16/02	1300			6 772	41	11 958	13
		02/16/02	1820			1 048	41	5 724	0
	*	02/17/02	745			2 101	42	1 201	1
		03/01/02	1507			1 402	54	3 095	12
		03/03/02	1812			0 416	56	0 986	2
		03/04/02	1008			1 805	57	2.029	1
		03/21/02	1730			1 484	74	1 317	17
		04/01/02	1235			5 042	85	4 494	11
		01/04/03	1428			**4.019**	**363**	**1.449**	**278**
		02/17/03	1201			**1.506**	**407**	2 513	44
	*	02/17/03	1317			**1.506**	**407**	0	0
		03/30/03	1315			**2.085**	**448**	2 235	41
*** Distance between 2001/2002 & 2002/2003 Frequented Locales**								**0.909**	
1807-52042		01/06/02	1732	ASY	F				
	*	02/02/02	1447			7 785	27		
		02/02/02	1800			13 432	27	6 977	0
	*	01/30/03	1031			**1.641**	**389**	**14.273**	**362**
*** Distance between 2001/2002 & 2002/2003 Frequented Locales**								**8.626**	

** Note on age codes· HY = hatch year; SY = second year; ASY = after second year

VITA

Paul W. Juergens was born in Rosenberg, Texas, on August 2, 1976. He is the son of Alton and Anne Juergens. After graduating from B.F. Terry High School in 1994, he entered Wharton County Junior College in Wharton, Texas, and began his undergraduate course work. He obtained his Bachelor of Science in Biology in 1998 from the University of Texas at San Antonio. After graduation he worked for a raptor rehabilitation and education organization in San Antonio, Texas and began participating in spring and autumn Peregrine Falcon migration surveys on South Padre Island, Texas. In 2000 he entered the graduate program in Wildlife Ecology at Texas State University-San Marcos in San Marcos, Texas. While at Texas State University-San Marcos, he worked as an instructional assistant for Modern Biology II and Wildlife Management. In 2003 he accepted a position as a wildlife biologist with a non-governmental organization called The Peregrine Fund.

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