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# BEHAVIOR OF PEREGRINES IN WINTER IN SOUTH TEXAS

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ABSTRACT.—The movements and other behaviors of seven radio-tagged peregrine falcons (*Falco peregrinus*) were determined in winter near the Laguna Madre in southern Texas in 1993 and 1994. In January and February most of the falcons hunted in areas 20–28 km across and showed extensive overlap. Most locations of falcons we monitored were on the vast tidal flats at the margins of the Laguna or over the shallow water where numerous perches are present in an otherwise featureless habitat. One adult female moved a maximum of less than 8 km. Four of the falcons we instrumented had been trapped in the area before, or remained months after the study. We estimated a minimum density of 20 peregrines inland of the beaches of South Padre Island, or about one bird per 50 km$^2$. The Gulf Coast of Texas and Mexico have several times the area of tidal flats we observed and the region is surely a major newly discovered wintering area for peregrines. We speculate that some peregrines may spend their first summer there.

KEY WORDS: *behavior; peregrine; radiotelemetry; Texas; winter dispersion.*

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Conducta de *Falco peregrinus* durante el invierno en el sur de Texas

RESUMEN.—En el invierno de 1993 y 1994 se determinaron los movimientos y otras conductas de siete individuos de *Falco peregrinus* radiomarcados, cerca de Laguna Madre en el sur de Texas. En enero y febrero la mayoría de los individuos capturados en áreas de 20 a 28 km de largo mostraron gran sobreposición. Estimamos que la mayoría de las localizaciones de halcones se realizaron sobre un vasto plano de mareas en el margen de la Laguna o sobre aguas poco profundas, donde numerosas perchas están presentes. Una hembra adulta tuvo un máximo de dispersión de menos de ocho km. Cuatro de los halcones instrumentados fueron capturados en el área o permanecieron meses después del estudio. Estimamos una densidad mínima de 20 halcones peregrinos al interior de las playas del Golfo de South Padre Island o cerca de un ave por km$^2$. Las Costas del Golfo de Texas y México parece ser una gran área invernal para halcones peregrinos. Especulamos que algunos individuos pasan su primer verano en este lugar.

[Traducción de Ivan Lazo]

Peregrine falcons (*Falco peregrinus*) have been studied in migration on the coast of Texas, in fall (Hunt et al. 1975) and in spring (Hunt and Ward 1988). Band recovery data indicated the migrants originated in the Arctic and wintered in Central and South America (Yates et al. 1988). Examination of winter band recoveries and Christmas Bird Counts from the coast of the Gulf of Mexico suggested the possibility of a substantial population (Enderson 1965). Sightings in winter near Brownsville, Texas, by L. Meredith (pers. comm.) in the 1950s and discovery of many peregrines on the Culiacán Marsh on the Sinaloa coast in western Mexico (Enderson et al. 1991) prompted us to search for peregrines in winter at about the same latitude in southern Texas. We report here on the behavior of winter resident peregrines determined by telemetry, estimate the area population, and speculate on the possibility that peregrines are present year-round on the coast of the Gulf of Mexico.

## STUDY AREA AND METHODS

We searched for peregrines on South Padre Island (SPI) south of the Mansfield Channel and the adjacent mainland (Fig. 1) from 9 January to 8 February 1993 and 1994. Searches on the island were made from dunes near the beach and by all-terrain vehicles on the vast leeward tidal flats. On the mainland we traveled the tidal flats adjacent to the Laguna Madre. We used a boat, airboat, and an airplane four times to visually verify the locations of birds on the Laguna. Trapping was done with rock doves (*Columba livia*) in noose-covered harnesses and radios were mounted on the two central rectrices as described in Enderson et al. (1991). We searched for all instrumented peregrines as weather permitted, roughly dividing our effort between island and mainland on alternate days.

Positions of instrumented falcons were determined by following radio signals to their sources or by triangulation of two simultaneous bearings taken from the 10 tallest

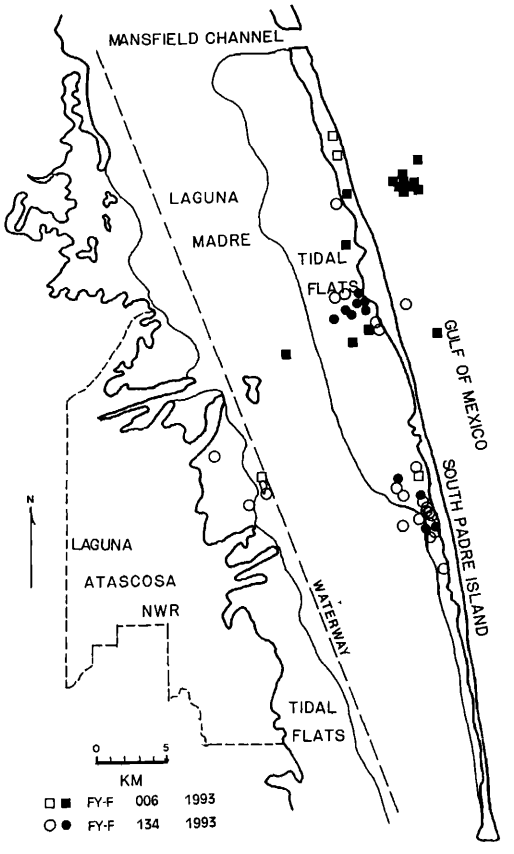


Figure 1. Locations of first-year peregrines in 1993. Open symbols are visual locations, closed symbols are telemetry triangulation locations; none are <1 hr apart, and were made over 20 d (006) or 32 d (134), January to February.

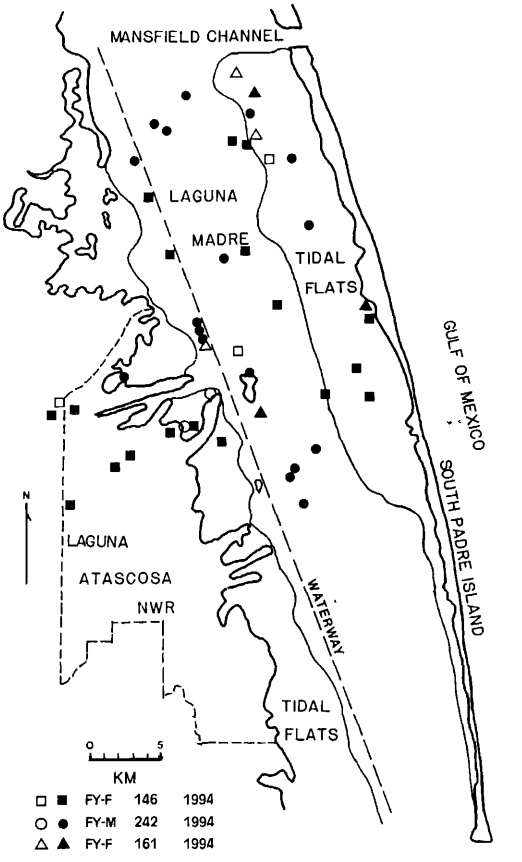


Figure 2. Locations of first-year peregrines in 1994. Open symbols are visual locations, closed symbols are telemetry triangulation locations; none are <1 hr apart and were made over a period of at least 17 d (161).

dunes along the northern 35.2 km of the island. We used dunes at least 4 km apart while obtaining bearings on signals. Maximum reception range from dunes was 10–15 km depending on the elevation of the falcon. On the mainland we used the highest points available for receivers, often dirt banks on islands overlooking vast tidal flats and the Laguna Madre. Receiver locations were determined by a geographical positioning system and verified on 7.5 min topographical maps. The great majority of fixes on transmitters were at distances less than 10 km because of the narrowness of SPI. When a signal was obtained we took fixes every 15 min in 1993 and every 30 min in 1994. When falcons were in motion we often tracked them continuously. Because several birds were instrumented in the same period and searches for lost birds were necessary, we could not always track each bird all day. We tracked each bird from dawn to dusk at least four times to learn its activity patterns. We often attempted to locate individuals visually, especially in 1993.

We tested telemetry accuracy by attaching three transmitters to fence posts and recording the degrees of error from true bearing from eight receiver locations 2.3–3.5 km away. The mean error of 40 trials was 2 degrees (range = 0–5 degrees; SD = 1.21 degrees). Under usual field conditions that average error could yield a maximum triangulation error of 1.5 km if the transmitter were 8 km from the two receivers and lateral to the midpoint of a line between them. If one standard deviation is added in the above example the error would be 3.2 degrees and a maximum error of 2.5 km in position would result. Actual error is dependent on the geometry of transmitter and receivers, and on the combination of bearing errors. Because 73% of our test bearings were less than two degrees of true bearing, 2 km was probably a conservative estimate of the maximum error, but a few estimates could be in error by twice that distance or more.

We minimized autocorrelation between sequential positions by dividing the total time each falcon was observed by the number of times the falcon flew to a different position. The average time between movements for all

Table 1. Observation periods and success in obtaining visual and telemetry locations for peregrines in winter in the Laguna Madre area of southern Texas, 1993–94. Accepted locations were separated by at least 1 hr.

| YEAR/ INDIVIDUAL | AGE[a] | SEX | OBSERVATION PERIOD (d) | DAYS LOCATED | ACCEPTED LOCATIONS VISUAL[b]—RADIO | LOC. < 120 MIN APART | MEAN NO. LOCATIONS PER DAY | EST. MAX. DIST.[d] (km) |
|---|---|---|---|---|---|---|---|---|
| 1993 | | | | | | | | |
| 115 | ASY | F | 27 | 16 | 30—4 | 3 | 2.1 | 7.5 |
| 006 | FY | F | 20 | 7 | 15—4 | 7 | 2.7 | 24.5 |
| 134 | FY | F | 32 | 17 | 24—11 | 4 | 2.0 | 26.5 |
| 1994 | | | | | | | | |
| 034 | ASY | F | 25 | 17 | 8—33 | 9 | 2.4 | 20.0 |
| 202[c] | SY | F | 24 | 12 | 3—17 | 3 | 1.7 | 20.0 |
| 242 | FY | M | 26 | 9 | 2—17 | 0 | 3.1 | 28.2 |
| 161 | FY | F | 17 | 5 | 3—3 | 1 | 1.2 | 23.7 |
| 146 | FY | F | 27 | 11 | 3—18 | 2 | 1.9 | 28.0 |

[a] FY = first year, SY = second year, ASY = after second year.
[b] Includes the trapping event.
[c] Same bird as 134 in 1993.
[d] Distance between most distant locations for each peregrine.

falcons was 48 min (SD = 19 min). To facilitate data selection we therefore accepted only visual or triangulation locations separated by at least 1 hr.

## RESULTS

We instrumented seven peregrines, one of which (134/202) was tracked in both years (Table 1). Trapping began 9 January each year and the latest any bird was caught was 19 January (006 in 1993). Sometimes several accepted locations were obtained per day, but the daily average for each bird was about three or fewer. Further, the majority of locations we accepted were separated by more than 2 hr (Table 1).

**Movements and Dispersion.** With one exception, instrumented peregrines were located both on SPI and on the mainland (Figs. 1–3). In general the falcons moved widely from the coastal region just inland from the beaches on the gulf westward to the margin of pastures and brushlands on the mainland. The exception was adult female 115 which was very sedentary on tidal flats adjacent to Laguna Atascosa National Wildlife Refuge (Fig. 3). The corridor of suitable habitat east to west is about 20 km wide in this region, corresponding roughly to the maximum spread of locations we found for these birds (Table 1). The north to south spread of locations for first-year peregrines on the Laguna was about the same distance as their east to west range.

About 115 of the 198 locations (58%) of peregrines shown on Figs. 1–3 were on island and mainland tidal flats. Another 53 locations (27%) were on the open water of the Laguna Madre where numerous perches were available. Remaining locations were on the mainland, island dunes, or on the gulf.

Immature peregrine 006 was banded in Greenland in 1993 and we found that she frequented the northern half of SPI and off-shore oil drilling towers (Fig. 1). Her observed range overlapped extensively with another first-year female (134) and had a similar maximum extent. Female 134 had been banded in late October 1992 on SPI by other workers (T. Maechtle pers. comm.).

In 1994, the movements of first-year peregrines 146 and 242 were best recorded; they moved between island and mainland several times and their positions were unpredictable (Fig. 2). Both were found on the Laguna Madre where dredge spoilings along the waterway or numerous stilt shacks, posts, markers, or wrecked boats provided perches.

An adult female (115) in 1993, adult female 034 in 1994, and the second-year female 202 in 1994, showed less dispersion in most of their estimated locations than did the first-year falcons (Fig. 3). Adult 115 was most predictable and sedentary (Table 1). We watched her with binoculars a total of 40 hr from 13 January to 8 February and she usually

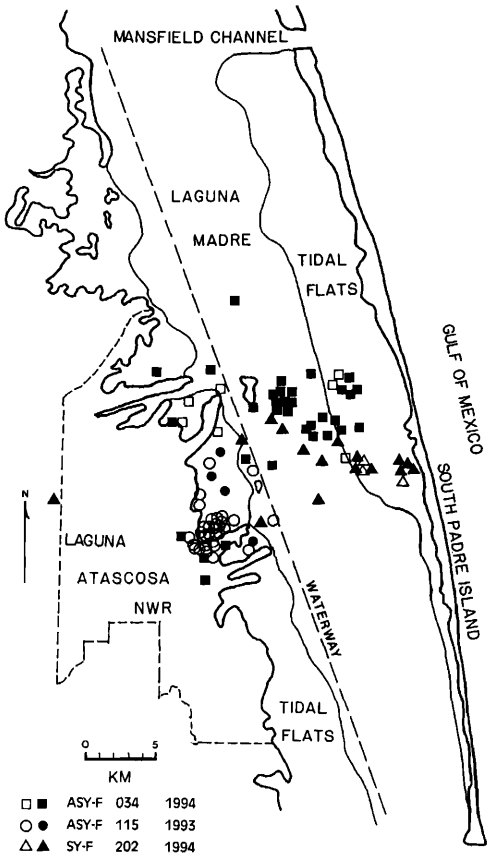


Figure 3. Locations of a second-year and adult peregrines in 1994 and 1993. Open symbols are visual locations, closed symbols are telemetry triangulation locations; none are <1 hr apart and all span at least 24 d (202).

perched within 300 m of a small lake used by hundreds of ducks.

Two falcons tracked in 1994 were retrapped by other workers 4 mo later on SPI tidal flats (T. Maechtle pers. comm.). Second-year female 134/202 was caught, her transmitter was removed, and she was released 11 April 1994 within 3 km of locations where radios were attached in 1993 and 1994. Female 134/202 had been banded on SPI in late October 1992 when only a few months old and may have spent much of her life on SPI. First-year female 161 was retrapped 12 April 1994 about 14 km south of Mansfield Channel on SPI (Fig. 2). Adult female 034, tracked in 1994 (Fig. 3) had been trapped on SPI in October 1990, and again in 1993 (T. Maechtle pers. comm.).

**Population Estimate in 1994.** In addition to the five falcons instrumented, we trapped a first-year female whose transmitter failed soon after release, and we saw many other peregrines. Two adult females roosted repeatedly on buildings in the town of South Padre Island and three first-year females, presumed to be different individuals, were on the refuge. In 1994, an adult female was seen nine times on the same perches used by 115 in 1993; we believe it may have been the same bird. Another especially dark-headed female was seen seven times 4 km south of the previous adult, and another adult was seen four times 10 km north of the apparently returning adult. Another adult female was seen several times on markers on the Mansfield Channel, and four more adults, apparently distinct from all those above, were seen on markers on the Intercoastal Waterway between the Refuge and the Channel.

If these sets of sightings were of different individuals, a minimum of eight adults occurred along the waterway, two in town, one on the Channel, and the two we tagged, yielding a total of 13. In addition to the three first-year peregrines we tagged, one with the broken transmitter was on SPI, and probably three additional individuals on the refuge, resulting in a minimum of seven first-year birds. By conservative estimate, there were about 20 individuals in the study area of about 1000 km$^2$, or about one bird per 50 km$^2$.

**Interaction and Food.** In both years we saw six instances of adult peregrines attacking conspecifics, both adults and first-year birds. One of the latter was chased by an adult about 1 km from SPI over the gulf, and another adult left a perch on a mainland tidal flat to chase another adult soaring about 2 km away. All attacks were vigorously aggressive resulting in the rapid departure of the attacked bird. However, twice adults did not chase nearby conspecifics.

We saw adult peregrines chase a ferruginous hawk (*Buteo regalis*), a northern harrier (*Circus cyaneus*), an osprey (*Pandion haliaetus*), and a turkey vulture (*Cathartes aura*). In a fourth incident, a vulture pirated a dead rock dove from a first-year peregrine by shuffling closer, side-stepping almost imperceptibly, until the feeding falcon was slowly forced to leave its prey in the shadow of the seemingly indifferent vulture. The vulture then fed on the pigeon.

**Prey.** We saw peregrines catch a redhead (*Aythya americana*), a northern pintail (*Anas acuta*), a Forster's tern (*Sterna forsteri*), and a laughing gull (*Larus atricilla*). An adult female chased a northern harrier, pirating the rodent it carried.

## DISCUSSION

The Laguna Madre and associated tidal flats on the east and west side create a vast, shallow, foraging habitat for uncountable numbers of wading birds and waterfowl. Over 35 000 redheads alone winter there (S. Thompson pers. comm.). Only the dunes on SPI and the low headlands on the mainland are not subject to frequent inundation. The margins of the laguna shift over several kilometers, resulting in a rich but featureless landscape devoid of places for prey to escape hunting peregrines. C. Thelander and P. Bloom (in Hunt and Ward 1988) found peregrines wintering in barren habitat in coastal Peru similar to SPI.

The majority of the positions of peregrines we determined were on tidal flats or adjacent perches on the Laguna Madre. Seldom did the falcons perch near the gulf beaches or fly inland to agricultural land. In the same area, Hunt and Ward (1988) located 24 radio-tagged peregrines on tidal flats about 67% of the time in the April 1979 and 1980 migration period.

Our observations of attacks on prey suggest hunting is often on the tidal flats, especially near the laguna. Perches on the laguna provided resting places for peregrines. This is unlike the many observations on the Culiacán Marsh in Sinaloa where most kills were over water and prey was limited to ducks and other birds small enough to be carried (Enderson et al. 1991).

In 1993, first-year peregrines seemed to move in different patterns (Fig. 1) compared to 1994 (Fig. 2). This may be a sampling artifact. In 1993, we usually sought to locate each bird visually, guided by telemetry; locations therefore included fewer inaccessible sites on the laguna. In 1994, locations produced mainly by triangulation were not limited in that way. However, maximum dispersion of first-year birds in both years was similar.

We saw about 20 individual peregrines in the Laguna Madre area south of Mansfield Channel in 1994. More were undoubtedly present but population estimation is risky. The extent of vast tidal flats is limited on the coast of the western Gulf of Mexico. Flats extend northward only 140 km from the town of South Padre Island. Based on our observations at the southern end, that region of tidal flats may have had 60 or more peregrines in 1994. There are vast flats southward 90 km in Mexico. Elsewhere along the gulf coast, peregrines may over-winter in other habitats. The Florida Game and Fresh Water Fish Commission recently estimated 200–300 arctic peregrines winter in the state (USFWS 1994).

Coastal Texas and adjacent Mexico, and the Maryland and Virginia coasts are the two major migration focal points of arctic peregrines (Yates et al. 1988). Kiff (1988) estimated the number of historical pairs of these northern peregrines at between 5000 and 8000; recently, Peakall (1990) considered the health of that population to be good. These migrants, including the greatly under-represented adult male component, move rapidly southward at SPI (Chavez-Ramirez et al. 1994) but some remain in winter. In April, northbound migrants stage at SPI prior to return to the Arctic, no doubt attracted by easy hunting. About 16% of 170 peregrines seen in spring on SPI in 1994 were retaining much of their first-year plumages, indicating some of these birds, about to become yearlings, move northward in their first spring (T. Maechtle and W. Seegar pers. comm.). Cade (1960) did not see yearling peregrines in arctic Alaska and we speculate some of these young birds may remain in summer, like Ospreys (Henny and Wight 1969), in the winter habitat of adults on the Laguna Madre.

The emerging picture is one of hundreds, perhaps thousands, of peregrines wintering on the southern coasts of North America each year. The present study suggests these birds may not be continually traveling. If peregrines elsewhere in winter show the degree of aggression toward conspecifics we saw, further study might confirm that adults, at least, are territorial in winter.

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## LITERATURE CITED

CADE, T.J. 1960. Ecology of the peregrine and gyrfalcon populations in Alaska. *Univ. Calif. Publ. Zool.* 63:151–290.

CHAVEZ-RAMIREZ, F., G.P. VOSE, AND A. TENNANT. 1994. Spring and fall migration of peregrine falcons from Padre Island, Texas. *Wilson Bull.* 106:138–145

ENDERSON, J.H. 1965. A breeding and migration survey of the peregrine falcon. *Wilson Bull.* 77:327–339.

———, C. FLATTEN AND J.P. JENNY. 1991. Peregrine falcons and merlins in Sinaloa, Mexico, in winter. *J. Raptor Res.* 25:123–126.

HENNY, C.J. AND H.M. WIGHT. 1969. An endangered osprey population: estimates of mortality and production. *Auk* 86:188–198.

HUNT, W.G., R.R. ROGERS AND P.J. SLOWE. 1975. Migration and foraging behavior of peregrine falcons on the Texas Coast. *Can. Field-Nat.* 89:111–123.

——— AND F.P. WARD. 1988. Habitat selection by spring migrant peregrines at Padre Island, Texas. Pages 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.

KIFF, L.F. 1988. Changes in the status of the peregrine in North America: an overview. Pages 123–139 *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.

PEAKALL, D.B. 1990. Prospects for the peregrine falcon in the nineties. *Can. Field-Nat.* 104:168–173.

U.S. FISH AND WILDLIFE SERVICE. 1994. Endangered and threatened wildlife and plants; removal of the arctic peregrine falcon from the list of endangered and threatened wildlife. *Fed. Regist.* 59:50796–50805.

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. Pages 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.

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