

## MEASUREMENTS OF FALL MIGRANT PEREGRINE FALCONS FROM TEXAS AND NEW JERSEY

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Three subspecies of Peregrine Falcons (*Falco peregrinus*) breed in North America: *F. p. anatum*, formerly bred in all eco-geographic regions of North America south of the Arctic tundra, except for the immediate vicinity of the northwest Pacific Coast; *F. p. tundrius* breeds in the Arctic tundra; and *F. p. pealei*, a relatively sedentary form, occupies the region of the northwest Pacific coast excluded from the range of *F. p. anatum* (Fyfe et al. 1976). Compared with *tundrius*, *anatum* is larger and darker, and the white auricular area is less extensive in proportion to the black malar stripe (White 1968a). This paper presents morphological information from two migrant populations. Also, measurements are compared with *F. p. tundrius* described by White (1968a,b), although shrinkage in study skins (the source of White's measurements) was recently documented (Fjeldså 1980) and confounds direct comparison.

### METHODS

Migrating Peregrine Falcons were captured, banded, and measured at South Padre Island, Texas, in late September through 15 October of 1976-1979 and at Cape May Point, New Jersey, in late September through early November 1970-1981 (88% by 15 October), but primarily 1976-1981. Peregrines were captured on South Padre Island, a barrier island, just north of the Mexican border, by the pigeon-harness technique (Beebe 1976:211). Standard measurements (Baldwin et al. 1931) were recorded in addition to the length of the foot pad. The foot pad was measured with dividers in a straight line from the tip of the middle toe pad to the tip of the hind toe pad, when both the middle toe and hallux were fully extended. Peregrines were captured at Cape May Point at the raptor banding stations described by Clark (1970, 1971). Standard weight and wing chord measurements were recorded there.

### RESULTS

*Wing chord measurements and weight.*—Measurements were obtained from 204 Peregrines although complete information was not obtained from all birds (Table 1). Females in juvenal plumage (hatching year = HY) were captured in the greatest numbers at both Cape May Point and Padre Island, and therefore provide the best information for comparison. An analysis of HY female wing chord measurements shows that the means for birds from Padre Island ( $t = 8.15$ , 82 df,  $P < .001$ ) and Cape May Point ( $t = 6.92$ , 94 df,  $P < .001$ ) were significantly greater than the mean for *F. p. tundrius* as described by White (1968a). Although the HY female wing chord mean was longer in birds from Padre Island than in those from Cape May Point, it was not significantly different ( $t = 1.34$ , 120 df,  $P > .10$ ).

The mean wing chord measurements for HY males from Padre Island

TABLE 1. Comparison of mensural information from fall migrant Peregrines at South Padre Island, Texas, and Cape May Point, New Jersey, with *F. p. tundrius*.

Category	ASY females	HY males	HY females
Wing chord (mm)			
<i>F. p. tundrius</i> <sup>a</sup>	352.4 ± 6.4 (333-368) 66 <sup>b</sup>	311.3 ± 4.5 (295-321) 29	350.7 ± 6.4 (333-367) 29
Padre I., TX	362.7 ± 8.8 (346-377) 16	317.7 ± 5.6 (308-325) 11	364.1 ± 7.6 (346-379) 55
Cape May Point, NJ	361.0 ± 5.7 (357-365) 2	319.4 ± 5.9 (305-331) 46	362.2 ± 7.9 (342-376) 67
Tail (mm)			
<i>F. p. tundrius</i> <sup>a</sup>	168.6 ± 5.6 (153-180) 71	152.5 ± 5.3 (143-162) 29	177.4 ± 5.5 (167-189) 32
Padre I., TX	167.1 ± 6.2 (156-177) 15	154.2 ± 6.0 (141-161) 11	181.4 ± 5.2 (168-191) 54
Bill without cere (mm)			
<i>F. p. tundrius</i> <sup>a</sup>	22.8 ± 0.30 (21-25) 64	18.3 ± 0.42 (17-22) 30	21.4 ± 1.1 (19-24) 32
Padre I., TX	22.4 ± 0.92 (19.7-23.5) 16	18.6 ± 0.67 (17.1-19.4) 11	21.8 ± 0.85 (20.3-25.1) 39
Weight (g)			
<i>F. p. tundrius</i> <sup>a</sup>	961 (825-1185) 21	570 (477-662) 5	897 (844-925) 8
Padre I., TX	1056 ± 71 (925-1175) 16	610 ± 43 (560-695) 14	946 ± 111 (720-1200) 57
Cape May Point, NJ	862 ± 39 (834-889) 2	578 ± 53 (496-782) 41	831 ± 83 (590-1042) 63
Foot pad (mm)			
Padre I., TX	95.2 ± 2.2 (92.6-100.0) 16	82.3 ± 2.1 (79.8-86.3) 11	96.3 ± 1.9 (92.8-100.3) 55

<sup>a</sup> From White (1968b, revised).<sup>b</sup> Mean ± standard deviation, range, sample size.

( $t = 3.75$ , 38 df,  $P < .001$ ) and Cape May Point ( $t = 6.52$ , 73 df,  $P < .001$ ) also were significantly greater than those for *F. p. tundrius* as described by White (1968a). Again, as with the females, mean HY male wing chord measurements for birds from Padre Island and Cape May Point were not significantly different ( $t = .87$ , 55 df,  $P > .30$ ). Since only one adult (after second year = ASY) male was captured during the study, and only 2 ASY females were captured at Cape May Point, the only sample of ASY wing chords sufficient for statistical testing with *F. p. tundrius* consisted of the ASY females from Padre Island. Again, the mean wing chord measurement was significantly greater than that of *F. p. tundrius* ( $t = 5.35$ , 80 df,  $P < .001$ ). The distribution of the HY wing chord measurements is presented graphically in Figure 1.

Both the HY females ( $t = 6.47$ , 118 df,  $P < .001$ ) and the HY males ( $t = 2.04$ , 53 df,  $P < .05$ ) from Texas weighed significantly more than their counterparts from New Jersey. The coefficient of variation for each HY series of weights showed no obvious pattern between locations: males (Texas 7.0, New Jersey 9.2), females (Texas 11.7, New Jersey 10.0).

*Tail and bill length measurements.*—Tail and bill without cere measurements were only recorded at Padre Island. Tail length comparisons between the Padre Island birds and *F. p. tundrius* as described by White (1968a) showed no significant differences for ASY females ( $t = 0.93$ , 84 df,  $P > .10$ ) or HY males ( $t = 0.87$ , 38 df,  $P > .10$ ); however, HY females ( $t = 3.38$ , 84 df,  $P < .01$ ) were significantly different. Bill length comparisons between Padre Island birds and *F. p. tundrius* showed no significant differences for HY males ( $t = 1.71$ , 39 df,  $P > .05$ ) or HY females ( $t = 1.73$ , 69 df,  $P > .05$ ); however, the ASY females were significantly different ( $t = 2.95$ , 78 df,  $P < .01$ ).

*Measurements of recovered or recaptured Peregrines.*—Mensural information was obtained in Texas from 3 banded Peregrines of either known origin or known wintering locality (Table 2). The measurements of an HY male *F. p. anatum*, captive-bred and released by the Canadian Wildlife Service in northeastern Alberta, and an HY female shot in Chaco Province, Argentina, were toward the middle of the range of those captured and measured in Texas; whereas an HY male found in El Salvador had the longest wing chord, one of the longest tails, and the longest bill without cere that was measured and released in Texas. One of the darkest colored HY Peregrines captured on Padre Island was the *F. p. anatum* released by the Canadian Wildlife Service. However, many of the HY birds captured on Padre Island had blond or light heads.

An HY female banded at an eyrie in western Greenland, approximately on the Arctic Circle, by William Heinrich and Thomas Smylie, on 28 July 1978, was recaptured 12 October 1978 at Cape May Point, New Jersey. Another HY female, banded at Cape May Point, 26 September 1976, was recaptured 24 days later at Padre Island (Table 2). The wing chords of these 2 birds were near the middle of the range of HY females captured at Cape May Point, but the weight of the bird

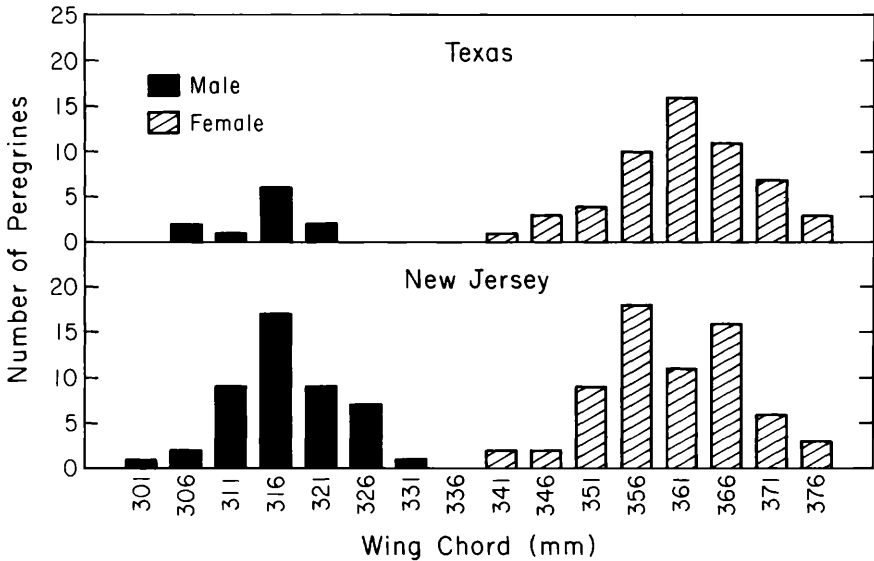


FIGURE 1. The distribution of wing chord measurements of HY Peregrine Falcons from Texas and New Jersey.

from Greenland (690 g) was below average. The recapture at Padre Island indicates that at least occasional mixing may occur between the Peregrine populations migrating along the Atlantic Coast and the Gulf Coast of Texas.

*Other band recoveries.*—Some supplementary information is available from reports of banded birds. Hunt et al. (1975) reported 3 long-distance band recoveries from Texas—one from Brazil, one from Panama, and one from above the Arctic Circle in the District of Franklin, Northwest Territories. Calef and Heard (1979) reported a *F. p. tundrius* banded in the District of Keewatin, Northwest Territories that was retrapped on Padre Island, Texas. More recently, 2 *F. p. anatum* banded on the Yukon River in Alaska were captured at North Padre Island, Texas, and an HY female Peregrine banded at North Padre Island on 5 October 1977 was recovered on the Yucatan Peninsula, Mexico, on 20 January 1978 (Henny et al. 1982).

Three HY Peregrines captured and banded at Cape May Point were captured again within 2 days on Assateague Island (one in 1977, one in 1979, and one in 1980), about 100 km south southeast. Another Cape May Point bird was captured on an island north of Venezuela 18 days after it was banded (HY male in 1979). Enderson (1965) summarized long-distance recoveries of fall migrants banded at Assateague Island as follows: Greenland (2), Ecuador (1), Uruguay (1), Colombia (1), Bolivia (1), Virgin Islands (1), Haiti (1), Argentina (1), Cuba (1), and Costa Rica (1).

TABLE 2. Mensural information from banded Peregrines that were subsequently recovered or recaptured.

Band number	686-04317	987-31012	987-31043	987-14109	369-400 <sup>b</sup>
Banding location	NE Alberta	Padre I., TX	Padre I., TX	Cape May Pt., NJ	W. Greenland
Date	22 July 1978	7 October 1977	3 October 1979	26 September 1976	28 July 1978
Recovery location	Padre I., TX	El Salvador	Argentina	Padre I., TX	Cape May Pt., NJ
Date	8 October 1978	26 November 1977	October 1980	20 October 1976	12 October 1978
Age and sex	HY male <sup>a</sup>	HY male	HY female	HY female	HY female
Wing chord (mm)	313	325	360	363	360
Tail (mm)	153	160	186	—	—
Bill without cere (mm)	18.5	19.4	20.8	—	—
Weight (g)	605	560	1000	788	690
Foot pad (mm)	83.5	80.5	94.6	—	—

<sup>a</sup> This *F. p. anatum* was captive-bred and released by the Canadian Wildlife Service.

<sup>b</sup> Zool. Mus. Copenhagen, Denmark. Also, red plastic band A54.

## DISCUSSION AND CONCLUSIONS

Some Peregrines stay at South Padre Island for a period of time during the fall. For example, an HY female captured on 30 September was recaptured on 9 October, and another HY female captured on 5 October was also recaptured on 9 October. Both birds gained weight between captures. This point is made because HY females from South Padre Island averaged 946 g while those from Cape May averaged only 831 g. A weight gain associated with the delay in migration may at least partially account for the heavier birds encountered at South Padre Island. The Peregrines at Cape May seem to migrate immediately through the area.

The mean wing chords of HY females and males from Peregrines captured in the fall at both Padre Island and Cape May Point were longer than those published for breeding *F. p. tundrius*, but did not differ significantly from each other. Likewise, wing chords for ASY females from Padre Island were longer than those for *F. p. tundrius*. The significant differences in mean wing chord measurements between breeding *F. p. tundrius* and the fall migrants from Texas and New Jersey are put in some jeopardy by study skin shrinkage. Fjelds  (1980), who evaluated post-mortem changes in measurements of grebes, concluded that wing measurements decrease by about 3%. A 3% adjustment added to *F. p. tundrius* wing chord measurements from study skins yielded the following: HY female 361.2 mm, which compared favorably with 362.1 mm from Cape May Point and 364.1 mm at Padre Island (the largest series of data); HY male 320.6 mm, which compared with 319.3 mm from Cape May Point and 317.7 mm from Padre Island; ASY female 363.0 mm, which compared with 362.7 mm from Padre Island. The distribution of the HY female wing chord (largest series of data) in Figure 1 shows a normal distribution for those captured in Texas, whereas a hint of a bimodal distribution exists in New Jersey. Could 2 disjunct populations be represented in New Jersey?

Unfortunately, in the case of migrant Peregrines in North America, the technique of assigning an individual, or even a sample of individuals, to a subspecies on the basis of measurements seems questionable. White (1968a:187) stated that the "relationship of habitat and racial affinity is not to be construed as a hard and fast condition with fixed lines. Rather, there is a dynamic interpopulation gene exchange along the ecotonal facies of tundra and taiga that are the zones of contact." Thus, a cline may be present that precludes the assignment of all individuals to a given subspecies. If a cline exists—and it probably does—more mensural information from the northern breeding grounds would be mandatory before hoping to understand the morphological patterns present, but the objective of assigning all individuals to a subspecies would be moot. We had hoped that mensural characteristics could be used to understand the breeding populations represented at the 2 migration sites which, in turn, would aid our interpretation of the pesticide residues encountered in blood plasma.

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