

## SEX AND AGE CHARACTERISTICS OF NORTH AMERICAN MERLINS

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During a study of the ecology and systematics of North American Merlins or Pigeon Hawks (*Falco columbarius*), it became apparent that few scientific collectors and bird-banders were able to correctly sex and age Merlins using external characters. In addition, little published data are available on sex and age variations in these poorly studied falcons except for Friedmann's review (1950). The purposes of this paper are to analyze sex and age variations in North American Merlins and to present criteria useful in sexing and aging individuals externally.

### MATERIALS AND METHODS

The data presented in this paper are based upon examination of over 1,500 museum specimens and upon field work in Newfoundland, Canada during 1969.

Although many different morphological characteristics were examined, only those showing significant patterns of sex and age variation are presented here. Only specimens whose gonads had been examined were used in establishing sex criteria. In establishing age criteria, I consider an immature Merlin to be any bird still in its juvenal plumage and, hence, less than about 14 months old. Merlins undergo only one annual molt extending from mid-April until late September. After a Merlin has completed its first annual molt, during the year following its hatching year, it is in a definitive plumage that will not change further with age, and I consider it to be an adult. Since the annual molt extends into the early portion of the fall migration, migrant adult Merlins will have the last of their recently molted flight feathers incompletely grown, whereas the rest of the feather coat is complete. On specimens collected during the period 15 August to 30 September, this characteristic was used as the ultimate criterion for establishing adult status. If a Merlin showed incompletely grown flight feathers, it was considered an adult; if no evidence of recent molt was found, it was considered an immature. This characteristic was particularly helpful in separating immature and adult females that resemble each other so closely.

Since North American Merlin populations show significant geographic differences in their morphology (Temple, 1972), sex and age variation will be considered separately in each of the three distinct North American breeding populations: the taiga Merlins (*F.c. columbarius* and *F.c. bendirei*), the Pacific coastal Merlins (*F.c. suckleyi*), and the prairie-parkland Merlins (*F.c. richardsonii*). Geographic distributions of these populations are portrayed in Figure 1.

The following linear measurements (in millimeters) were taken using the standard methods described by Baldwin *et al.* (1931): wing chord, tail length, and tarsal length.

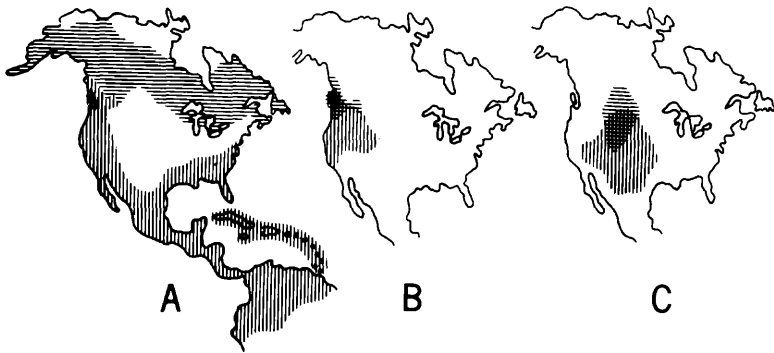


FIGURE 1. The geographic distributions of the three major populations of Merlins in North America: (A) Taiga populations, (B) Coastal Forest population, (C) Prairie-parkland population. Horizontal hatching designates breeding ranges; vertical hatching designates winter ranges.

Plumage characteristics were examined in detail since they are important in revealing sex and age. Dorsal plumage coloration in the interscapular region was quantified using a reflectance spectrophotometer as described by Selander *et al.* (1964). The results of this spectral analysis are expressed in three standard colorimetric units: dominant wavelength (hue), brightness (brilliance), and excitation purity (saturation). The use of these colorimetric units allows quantitative comparisons to be made between sex and age classes (see Temple, 1972, for a further discussion of this technique.).

Two other color characters of the plumage were recorded visually. The color of the rump feathers and upper tail coverts was recorded as being either dark brown or slate-brown. Also the color of the light bands in the central rectrices was scored as being either buff or light gray.

#### RESULTS

*Sexual Dimorphism.* As is typical of the genus *Falco*, for most measurements, female Merlins are larger than males. Table 1 gives comparative measurements for males and females in the three North American populations of Merlins. Despite inter-population differences in size, the degree of sexual size dimorphism is quite constant in all three populations.

Sexual dichromatism is marked in adult Merlins. The dominant wavelengths of plumage colors given in Table 2 indicate the difference between the slate-blue dorsal plumage of the adult male and the brownish plumage of the adult female. Immature Merlins do not show sexual differences in any colorimetric character of the dorsal plumage. Immature males and females do, however, differ significantly in the color of the light tail bands; immature males

TABLE 1. Measurements of North American Merlins.

	No. of specimens	Wing (mm) <sup>a</sup>	Tail (mm) <sup>a</sup>	Tarsus (mm) <sup>a</sup>
Taiga				
Males				
Adult	38	189.2 ± 4.6	115.5 ± 2.9	35.4 ± 1.4
Immature	33	190.5 ± 5.1	117.1 ± 3.1	35.2 ± 1.4
Females				
Adult	33	211.7 ± 3.9	127.6 ± 4.0	37.8 ± 0.9
Immature	40	211.5 ± 4.3	130.2 ± 3.8	37.9 ± 1.4
Coastal Forest				
Males				
Adult	13	189.9 ± 2.4	117.4 ± 1.9	35.4 ± 1.1
Immature	26	189.9 ± 3.6	117.3 ± 3.1	35.7 ± 1.2
Females				
Adult	18	210.4 ± 4.5	129.0 ± 3.4	38.3 ± 0.9
Immature	42	210.1 ± 5.1	130.5 ± 2.7	38.3 ± 0.9
Prairie-Parkland				
Males				
Adult	29	197.6 ± 3.3	120.5 ± 2.5	35.9 ± 1.0
Immature	31	198.1 ± 3.1	121.7 ± 3.1	35.8 ± 1.1
Females				
Adult	22	217.2 ± 4.4	132.1 ± 3.7	38.4 ± 1.1
Immature	27	218.8 ± 4.7	134.1 ± 3.2	38.6 ± 1.3

<sup>a</sup>Mean ± SE

always have light gray bands whereas immature females have buffy bands. This character held true in all specimens examined.

*Age Dimorphism.* Immature birds of both sexes closely resemble the adult female in dorsal coloration. This similarity is shown by the nearly identical colorimetric characters of the dorsum in Table 2. A subtle but consistent difference in plumage coloration does, however, exist between adult females and immatures. The rump and upper tail coverts of the adult female are slate-brown in contrast to the dark brown of the back, whereas the rump and upper tail coverts of immatures are the same shade of brown as the back. Once again, this character was reliable in all specimens examined, and only in specimens that showed extreme bleaching of plumage color was it difficult to discern.

Observations of captive Merlins show that both males and females acquire their definitive adult plumage with their first prebasic molt which occurs from April until September of the calendar year following their hatching year.

TABLE 2. Dorsal coloration of North American Merlins.

	No. of specimens	Dominant wavelength <sup>a</sup> (m $\mu$ )	Brightness <sup>a</sup> (%)	Purity <sup>a</sup> (%)
Taiga				
Males				
Adult	10	476.9 $\pm$ 5.1	17.6 $\pm$ 0.6	3.9
Immature	10	583.6 $\pm$ 4.6	26.4 $\pm$ 0.7	1.5
Females				
Adult	10	582.7 $\pm$ 4.1	25.2 $\pm$ 0.7	1.4
Immature	10	584.3 $\pm$ 5.0	25.7 $\pm$ 1.1	1.5
Coastal Forest				
Males				
Adult	3	476.2 $\pm$ 4.0	15.6 $\pm$ 0.6	4.0
Immature	5	582.3 $\pm$ 4.2	23.4 $\pm$ 0.4	1.6
Females				
Adult	5	575.7 $\pm$ 2.1	23.4 $\pm$ 0.5	1.7
Immature	5	579.4 $\pm$ 3.0	23.9 $\pm$ 0.4	1.7
Prairie-Parkland				
Males				
Adult	5	471.9 $\pm$ 5.0	21.1 $\pm$ 0.6	5.1
Immature	5	586.5 $\pm$ 4.0	29.4 $\pm$ 1.4	3.9
Females				
Adult	5	590.1 $\pm$ 3.4	29.1 $\pm$ 0.6	5.0
Immature	5	591.9 $\pm$ 4.8	30.1 $\pm$ 0.5	4.8

<sup>a</sup>Mean  $\pm$  S E

## DISCUSSION

Several authors have speculated on the biological function of sexual size dimorphism in birds of prey. One of the best founded theories is that such size dimorphism allows a breeding pair of hawks to avoid competition for the prey resources in their breeding territory (Selander, 1966). Another tenable theory states that the larger size in females permits female dominance over the male at the nest, thus integrating the pair and preventing male aggression toward nestlings (Cade, 1960). The Merlins studied in Newfoundland seem to offer some evidence for both of these theories. At one intensively studied nest, 79 per cent of the 19 prey items brought to the nest during the first week after hatching were species of birds weighing under 50 g. Because during this time the female was almost constantly brooding the nestlings, these food items represent the prey taken by males and brought to the nest for the female and the young. Of 109 food items identified at the nest from the end of the first week until fledging, only 27 per cent of the food items were species weighing under 50 g. During this

period, the female resumed regular hunting and contributed an increasing portion of the food for the young. These data suggest that males prey on smaller species than females, as might be expected from the male's smaller body size. From observations of the bird flushed from the nest, male Merlins appeared to contribute substantially to the incubation of the eggs, being on the nest about 1/3 of the times that birds were flushed. After hatching, the males were rarely on the nest when I approached. Often when the male did stay at the nest while delivering food, the female aggressively forced him to leave. These latter observations suggest that female dominance exists at the nest, particularly after the young have hatched.

Despite the striking age dichromatism in male Merlins, immature males can and perhaps regularly do establish territories and successfully acquire mates. Out of 20 pairs of breeding Merlins in Newfoundland in 1969, three pairs contained males that were undergoing their first prebasic molt and were not yet in definitive adult plumage. All three pairs were successful in their breeding attempts and fledged young.

*Criteria for Sexing and Aging Merlins.* The following dichotomous key can be used for sexing and aging Merlins in the hand.

- A Dorsal plumage slate-blue in color. . . . . Adult male
- AA Dorsal plumage brownish in color. . . . . B
- B Rump and upper tail coverts slate-brown in contrast to brown back. . . . . Adult female
- BB Rump and upper tail coverts same shade of brown as rest of back. . . . . C
- C Light bands in tail gray-colored. . . . . Immature male
- CC Light bands in tail buffy-colored. . . . . Immature female

#### SUMMARY

Sex and age variation were studied in North American Merlins, and reliable sexing and aging criteria were found.

The dorsal plumage of adult males is slate-blue whereas adult females and immatures are brownish. Adult females have a slate-brown rump and upper tail coverts in contrast to brown rumps of immature birds. The light bands in the tail of immature males are light gray and, in immature females, buffy.

Female Merlins averaged larger in size than males; this may be adaptive for integrating the pair during the breeding season as suggested by sexual differences in feeding habits and behavior at the nest.

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