

LATITUDINAL VARIATION IN SEX RATIOS OF BELTED KINGFISHERS

JEFFREY F. KELLY¹

*Department of Biology
Colorado State University
Ft. Collins, Colorado 80523 USA*

Abstract.—Data from the Bird Banding Laboratory and Christmas Bird Counts indicated that northern populations of Belted Kingfishers (*Ceryle alcyon*) were composed of proportionately more males than southern populations during fall and winter. The pattern of male bias in northern populations was also evident in fall/winter census data from an intensive study in Colorado, USA. Bird Banding Laboratory data indicated that the fall/winter trend in sex ratio was not maintained during spring/summer.

VARIACIÓN LATITUDINAL DE LA PROPORCIÓN DE SEXOS EN *CERYLE ALCYON*

Sinopsis.—Datos obtenidos del Laboratorio de Anillamiento Nacional y de los Censos de Navidad indican, que durante el otoño y el invierno, las poblaciones del norte de *Ceryle alcyon* están compuestas por una proporción mayor de machos que las poblaciones del sur. El patrón de sesgo, en los machos de las poblaciones del norte, también fue evidente en datos obtenidos de censos que se llevaron en un estudio conducido durante el otoño y el invierno en Colorado. Los datos del Laboratorio de Anillamiento Nacional indican que la misma tendencia, en la tasa de sexos, no se mantiene durante la primavera y el verano.

In many temperate bird species sex ratio varies with latitude during winter (Gauthreaux 1982, Ketterson and Nolan 1983). This pattern has been attributed to differential migration of the sexes resulting from differences in body size, social dominance, and/or benefits of early arrival on breeding grounds (Ketterson and Nolan 1976, Myers 1981). Because the larger sex is often socially dominant and arrives first on the breeding ground, it is often difficult to determine the relative contribution of these factors to patterns in winter sex ratio (Arnold 1991). Overlapping predictions of hypotheses and the large spatial and temporal scales involved make determining the causes of latitudinal variation in sex ratio difficult. Because of these constraints, comparing patterns in sex ratio from a diverse array of species is a primary means of testing competing hypotheses.

Belted Kingfishers (*Ceryle alcyon*) are partial migrants that occur throughout North America. Hamas (1994) conducted a literature review of the biology of this species, but reported no information on the sex ratio of migrant Belted Kingfishers. Our knowledge of the migratory behavior of Belted Kingfishers is poor, but some individuals appear to migrate south in September and October and return north in March and April (Salyer and Lagler 1946, White 1953). Because the Belted Kingfisher has an unusual life history and is the only member of the Family Alcedinidae in most of the US and all of Canada, data on latitudinal sex-ratio variation in this species have potential to broaden our understanding of the extent and importance of these patterns among birds in North America.

¹ *Current address: USDA For. Serv., Rocky Mtn. For. and Range Exp. Sta., 2205 Columbia SE, Albuquerque, New Mexico 87106 USA.*

METHODS

Belted Kingfishers have plumage dimorphisms that distinguish the sexes. The most obvious of these are the dichromatic pectoral bands. While the variation in these bands within and among sexes has not been quantified, these plumage characteristics are commonly used to determine the sex of hatch year and after-hatch year birds (Hamas 1994). I used these pectoral bands to determine the sex of Belted Kingfishers seen during weekly censuses of a 15.5-km stretch of Cache la Poudre River in Fort Collins, Colorado, USA (40°35'N, 105°05'W). The few birds (<1/census) whose pectoral bands could not be clearly seen were recorded as unknown sex. I conducted censuses from October–March of 1993–1994 and 1994–1995. I constrained censuses to this time of year because kingfishers begin to migrate, nest, and use seasonal habitats, such as ponds and irrigation canals, in March. Thus, censuses conducted after this time are probably not comparable to those done in winter.

I used two data sets to quantify continental variation in sex ratio of kingfishers. First, I used census information provided by volunteers participating in The National Audubon Society's 1994 Christmas Bird Counts. Second, I used records of kingfishers banded in North America between 1957 and 1993. I examined the 1993 National Audubon Society's Christmas Bird Counts (CBC) and selected 150 count coordinators. I requested that these coordinators record additional information on kingfishers in 1994. I sent at least one request to each of the Canadian provinces and United States except Hawaii. I requested that counters record the number of male and female Belted Kingfishers.

To determine if the relationship between sex ratio and latitude changed seasonally, I obtained all records of Belted Kingfishers banded in the U.S., Canada, and Mexico between 1957 and 1993 from the US Fish and Wildlife Service's Bird Banding Laboratory (BBL). I divided the records into those birds caught between October and March (fall/winter) and those caught between April and September (spring/summer). I grouped captures into 1° latitude blocks for analysis; all latitudes with >10 observations were included. This procedure excluded the few birds recorded at <34, 38 to 39, 46 to 47, 50 to 55, and >56°N latitude in the CBC data. For the BBL data, birds captured at <24, 29 to 30, 32 to 34, and >44°N latitude in the fall/winter and those captured at <29 and >50°N latitude in the spring/summer were excluded. Sample sizes were greater in the spring/summer BBL data (\bar{x} = 95, SD = 108 observations/1° latitude) than in the fall/winter BBL data (\bar{x} = 22, SD = 11 observations/1° latitude); the number of samples in the winter CBC data (\bar{x} = 36, SD = 20 observations/1° latitude) were intermediate. I analyzed both the CBC and BBL data with Spearman's rank correlations.

RESULTS AND DISCUSSION

Along the Cache la Poudre River 15% (SD = 9%, n = 21 censuses) of kingfishers were females in 1993–1994 and 9% (SD = 9%, n = 25 cen-

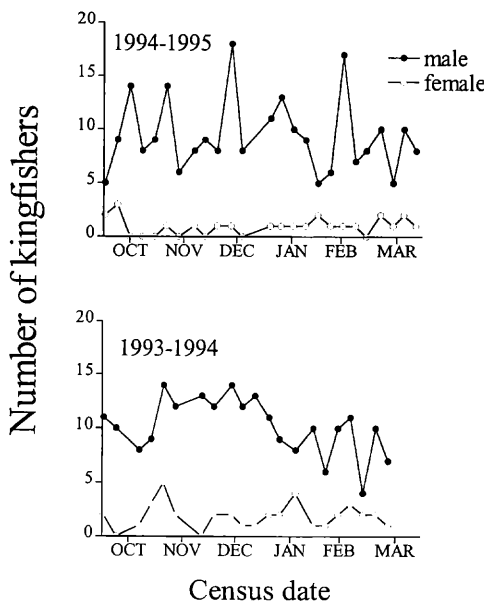


FIGURE 1. The number of male and female Belted Kingfishers counted during censuses along the Cache la Poudre River, Colorado in the fall/winter of 1993–1994 and 1994–1995.

suses) were females in 1994–1995 (Fig. 1). Both the BBL and CBC data indicated that, during fall/winter, there was a significant negative correlation between latitude and percent of the Belted Kingfishers observed that were female (Figs. 2a, b). This correlation was not apparent in the spring/summer BBL data (Fig. 2c).

As is true for many other bird species, during fall/winter northern populations of Belted Kingfishers are composed of proportionately more males than southern populations. Because the data analyzed here were collected with different amounts of effort, in different years, and at different locations, they can provide only a general picture of how sex ratios change with latitude and season. However, the male-biased sex ratio in a local Colorado population and the negative correlations in both continental data sets during fall/winter contrasted with the lack of correlation found in the spring/summer BBL data. This contrast suggests differential migration of the sexes. Without any direct evidence that individual females migrate farther than individual males, however, these patterns need to be interpreted cautiously. Sex-biased dispersal, mortality, or detectability that vary by latitude and season could provide alternative explanations for these patterns. Nonetheless, these data indicate a clear trend in sex ratio across the geographic range of Belted Kingfishers in North America during fall/winter.

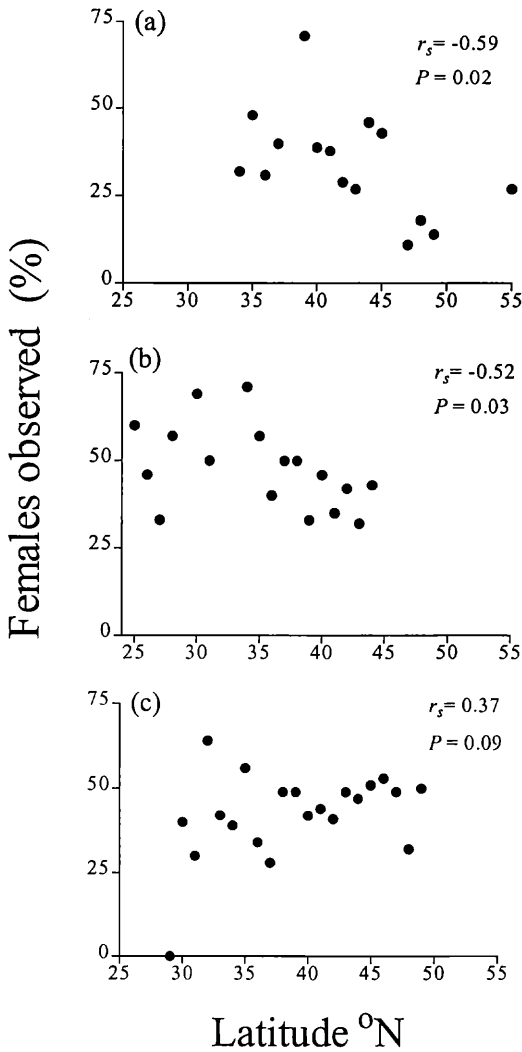


FIGURE 2. Percent of Belted Kingfishers that were female plotted against latitude for: (a) Christmas Bird Count data (1994); (b) fall/winter Bird Banding Lab data (1957-1993); and (c) spring/summer Bird Banding Lab data (1957-1993).

ACKNOWLEDGMENTS

I thank Mike Baker, Kurt Fausch, Francis James, Andrew Kinsey, Robert S. Mulvihill, Sandy Pletschet, Julie A. Robinson, Paul Stapp, Bea Van Horne, John Wiens, and Peter Woodall for their comments; and the numerous ornithologists who collected the data presented here.

LITERATURE CITED

- ARNOLD, T. W. 1991. Geographic variation in sex ratios of wintering American Kestrels *Falco sparverius*. *Ornis Scand.* 22:20–26.
- GAUTHREAUX, S. A. JR. 1982. The ecology and evolution of avian mating systems. Pp. 161–220, in D. S. Farner, J. R. King, and K. C. Parkes, eds. *Avian biology*. Vol. 9. Academic Press, New York.
- HAMAS, M. J. 1994. Belted Kingfisher, *Ceryle alcyon*. No 84. In A. Poole and F. Gill, eds. *The birds of North America*. Academy of Natural Sciences, Philadelphia and American Ornithologists' Union, Washington, D.C. 16 pp.
- KETTERSON, E. D., AND V. NOLAN, JR. 1976. Geographic variation and its climatic correlates in the sex ratio of eastern-wintering Dark-Eyed Juncos. *Ecology* 57:679–693.
- , AND ———. 1983. Evolution of differential bird migration. *Curr. Ornith.* 1:357–402.
- MYERS, J. P. 1981. A test of three hypotheses for latitudinal segregation of the sexes in wintering birds. *Can. J. Zool.* 59:1527–1534.
- SALYER, J. C., AND K. F. LAGLER. 1946. The eastern Belted Kingfisher, *Megaceryle alcyon alcyon* (*Linnaeus*) in relation to fish management. *Trans. Am. Fish. Soc.* 76:97–117.
- WHITE, H. C. 1953. The eastern Belted Kingfisher in the maritime provinces. *Bull. Fish. Res. Board of Canada.* 97:1–44.

Received 4 Mar. 1997; accepted 2 Jun 1997.