of borders. It is also possible that the 2 extra birds at Box B were nest helpers (Wegner, Wilson Bull. 88:670, 1976). However, nest helpers at Red-tailed Hawk (*Buteo jamaicensis*; Wiley, Condor 77:480–482, 1972) and Harris Hawk (Mader op. cit.) nests were as aggressive as the nesting pair. The combined evidence from the 2 breeding seasons suggests that double brooding may occur in American Kestrels in southeastern Colorado.

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Further comments on sexual size dimorphism in birds.—Ralls (Wilson Bull. 88:149–150, 1976) published a note on extremes of sexual size dimorphism among birds. We corresponded on the subject and this was useful to me as I was then writing on the selective basis for the "reversed" dimorphism that exists in birds of prey (Amadon, Raptor Research 9:1–11, 1975). I did not, however, see her manuscript and here offer a few additional comments on the subject. Ms. Ralls observed that Lack (Ecological Adaptations for Breeding in Birds, Methuen, London, 1964:161) quoted me (Amadon, Proc. Am. Phil. Soc. 103:531–536, 1959) as source that the Australian Brown Songlark *Cinclorhamphus cruralis* is an extreme example of sexual size dimorphism in passerine birds, while the hawk *Accipiter fasciatus vigilax* shows the extreme of size divergence among those birds in which the female is the larger size. She adds for both examples: "the figures Lack gives are not in the paper by Amadon he cites." Of the *Accipiter* this is literally true; they are from an earlier paper (Amadon, Wilson Bull. 55:164–177, 1943) and are for *weight*, not *wing length* as Lack has it. The measurements of *Cinclorhamphus* are in the 1959 paper but again are for weight not wing length!

This confusion does raise the question: What is the best general measure of difference in body size? In my 1959 paper, cited above, which is a review of the subject, I noted that in most species of birds and mammals males compete for females and are the larger sex; while in the few groups in which females compete for males (phalaropes, for example) females are larger. Furthermore, dimorphism is usually greater in polygamous or polygynous species in which a few males do most of the mating and individuals of that sex are hence to a degree, expendable. Competition for mates often consists largely of display and threats but actual physical conflict is always latent, and overall body size and prowess, of which gross weight is the best available measure, provide the basis for the selection.

Considering now the extremes of sexual size dimorphism in the Class Aves, in a few polygynous or promiscuous species such as the Capercaillie (*Tetrao urogallus*) the weight of males averages a trifle more than twice that of females. *Cinclorhamphus cruralis*, mentioned above, is uniquely dimorphic for a passerine bird (and perhaps for all birds).

Combining weights of several individuals from South Australia for which I am indebted to Dr. L. L. Short, with those I (1959:533) published earlier, we have the following: 6 ♂♂, 65–83 (69) g; 4 ♀♀, 28–32 (31) g; the males thus average 2.2 times heavier than the females. A few weights of the smaller and only other species of the genus, *C. mathewsi*, also supplied by Dr. Short, indicate that it is less strikingly dimorphic: 6 ♂♂ average 39 g and 3 ♀♀ 23.5 g; thus the males average 1.6 times heavier than the females. Dr. Short informs me that the flight displays of the large males of *Cinclorhamphus cruralis* cover a wide area and he thinks it highly likely that the species is polygynous.

In birds in which secondary sexual behavior is "reversed," such as phalaropes, females, as noted above, are larger, but not greatly so; perhaps they weigh 10 or 15% more than the males. In hawks and owls also females are larger than males, even though courtship and parental care roles are not reversed. The selective basis for this dimorphism is debated; I (Amadon 1975) think it is because in these aggressive, taloned, predatory species females would be in peril from males at pairing time, were they not larger and able to be the dominant partner. In various species of *Accipiter*, females average about 1.7 times as heavy as males, and if pairing is random some males will have mates of twice their own weight. For example Piechocki (*in* Glutz, Bezzel and Bauer, Handbuch Vogel Mitteleuropas, 4, Akademische Verlag, Frankfurt, 1971:420) gave the weights of a series of *Accipiter nisus* as 13 ♂♂ 134–162 (149) g; 58 ♀♀ 220–310 (258) g. Dimorphism in some of the other species of the genus *Accipiter*, for example the American *A. striatus*, is similar; I (1943 op. cit.) used *A. fasciatus vigilax* of New Caledonia merely because a series of weights was available. Judging from skins, I suspect there may be a few species of raptors in which females will be found to average twice as heavy as males: for example *Erythrotriorchis radiatus*, or *Hieraaetus kienerii*.

Some of the data presented by Ralls are in the form of cube root of weight. This statistic is useful when it is necessary to compare weights with linear measurements—it reduces the weight to a linear equivalent (Amadon 1943); but, as stated above, it would appear to be the weight, mass, or bulk of a bird *per se* that provides the selective material for sexual size dimorphism, and the raw weights themselves should be used.

Ralls used 2 other measurements in her comparisons: wing length and total length. The latter is rarely employed because differences in the make of museum specimens, and other factors, render it somewhat unreliable. Also, total length in birds as usually defined includes the tail (feathers), which are not really part of the body. This measurement does, however, suggest a different category of sexual dimorphism in birds; one that reaches its extreme in such species as the African Long-tailed Whydah, *Euplectes progne delamerei*. In breeding plumage males of this weaver-finch are 50 to 60 cm long, of which 75%, roughly, is represented by the very long tail feathers. Females are only about 15 cm long, so measured this way the males are about 4 times as long as the females. Such dimorphism is based largely upon insubstantial feathers and does not reflect true body size. But in another sense it is size dimorphism: the male whydah looks very much larger than his mates, and does fill more space. Some pheasants (*Rheinardia*, *Pavo*) and a few other birds equal or approach the dimorphism in display characters found in *Euplectes*.

This kind of dimorphism, unlike that in weight, is presumably based not upon physical competition for mates but rather upon sexual selection in a Darwinian sense. During the evolution of such species, females have tended to prefer males that were superior in display and the "ornaments" that go with it. Not unexpectedly this type of sexual dimorphism also has been able to proceed further in polygynous or promiscuous species such as those cited. Still, some monogamous species such as the Quetzal, *Pharomachrus mocinno*, are strikingly dimorphic.

As to comparative sexual size dimorphism in birds and mammals, no birds, as Ralls noted, approach the degree of disparity in weights found in a few mammals (elephant-seals, *Mirounga*, etc.) in which the male weighs several times as much as the female. Mammals are also far ahead in the development of bulky weapons (antlers), though a few birds are spurred. On the other hand, as befits their visual orientation and the structural plasticity yet light weight of feathers, some birds far exceed mammals and perhaps any other group of animals in the size of display ornaments.—D. AMADON, *American Museum of Natural History, New York, NY 10024.* *Accepted 7 Sept. 1976.*