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Short Communications

Response to Kirkley

David L. Goldstein
Department of Biological Sciences, Wright State University, Dayton, OH 45435

Neal G. Smith
Smithsonian Tropical Research Institute, Apartado 2072, Panama, Republic of Panama

Smith (1980, 1985), and later Smith et al. (1986), presented the hypothesis that some raptors (Swainson's Hawks, *Buteo swainsoni,* and Broad-winged Hawks, *Buteo platypterus,* in particular) might fast during portions of their soaring migration, and we considered the question of whether these birds could store sufficient energy to fuel long-distance soaring. Kirkley has reconsidered several of the arguments presented by Smith et al. (1986) and concludes that fasting is unlikely. These reconsiderations involve questions of energetics, water balance, and ecology. Each of these points deserves some discussion.

Smith et al. (1986) noted that no feces were found under trees where mass roosts of migrant hawks spent the night. Kirkley suggests that perhaps the hawks feed in early morning and completely eliminate their feces prior to roosting. This seems a reasonable and testable hypothesis. It might be substantiated, for example, by observations of early morning feeding by large flocks of migrant Swainson's or Broad-winged Hawks. At present, we are unaware of reports of such feeding bouts.

The energetics model presented by Smith et al. (1986) examined the mass of fat that would be required to fuel flights of different durations. What would be the migration range based on a reasonable mass of stored fat? We concluded that ". . . migration by the hawks without feeding from the southern U.S. to northern South America would require deposition of fat amounting to 20-25% of lean body mass. Although such fat deposition has not been recorded for raptors, this is within the range commonly measured in migratory birds of other taxa (and so) our calculations suggest that a long-distance fasting migration is physiologically reasonable." According to the model, deposition of this mass of fat would fuel a migrating Swainson's Hawk for approximately 2.5 wk and 4000-4500 km. Kirkley sets up something of a straw man in his argument, choosing to focus on flights of longer distance (9000 km) and duration (up to six weeks). Although we calculated that such a prolonged fasting migration would require greater than 50% mass gain as premigratory fat, we never suggested that the hawks actually accomplish this level of fattening. We might also note that measurements of premigratory fat deposition in large birds with migratory strategies like Swainson's and Broad-winged Hawks are simply unavailable.

Kirkley also argues that negative water balance would preclude a fasting migration. It is generally acknowledged that metabolic water will rarely match evaporative water losses in birds, and only a few small species, mostly desert-adapted birds, can survive on a dry diet (Bartholomew 1972). One might therefore expect a fasting hawk to lose body mass from a water deficit. Nevertheless, this argument does not preclude a prolonged fast. First, several large birds, including species of geese and penguins, do endure prolonged fasts (Cherel et al. 1988). Second, Kirkley has based his calculations on rates of evaporation measured on normally hydrated birds under conditions of low humidity in the laboratory. Evaporative water loss is reduced in high humidity environments (Lasiewski et al. 1966, Webster and King 1987), and can also be physiologically modified in water-stressed birds (Arad et al. 1987). Thus, the ambient and physiological conditions during migration may affect rates of evaporation. Actual measures of physiological condition of migrating hawks, such as permeability of the skin to water vapor, plasma and urine osmotic concentrations, or plasma concentrations of antidiuretic hormone, might elucidate the physiological condition of these birds with respect to water balance.

Finally, Kirkley argues that it just doesn't make sense for the birds to fast as they cross the insect-rich tropics and sub-tropics, and again he argues in terms of a six week, 9000 km flight. In contrast, we have suggested that it might be difficult for an individual bird to procure a substantial meal among a dense crowd of conspecifics. First, Broad-winged Hawks are not highly insectivorous. Second, the migratory passages of Broad-winged and Swainson's Hawks are quite highly circumscribed, suggesting that individuals do not drop out to feed for any extended period. It is not obvious that insects, or other prey, would be easily available to dense concentrations of these large birds, especially in forested regions. Finally, and again, we did not suggest that the fast persists for so long as Kirkley implies.

An overriding impression one receives from this set of arguments is that much of our understanding of the migration strategy of Swainson's and Broad-winged Hawks remains conjectural. What is the appropriate lean body mass? How much pre-migratory fat is deposited? Do the hawks eat or drink *en route*? What is the physiological condition of the birds at different stages of migration? What were the historical evolutionary forces that promoted the strategy of mass migration? Kirkley has not provided data bearing on any of these points. We believe that the available data remain consistent with the hypothesis of a fasting migration for some substantial portion of the flight of Swainson's Hawks and Broad-winged Hawks. However, this certainly remains a hypothesis, and only data collected from pre-migratory and migratory birds will provide evidence for or against it.

RESUMEN.—Kirkley considera que los gavilanes de las especies *Buteo platypterus* y *B. swainsoni* no pueden llevar reserva de grasa, ni pueden tolerar la pérdida de agua para migrar en ayunas, como lo propone Smith et al. (1986), y que por tanto deben alimentarse. Sin embargo, la migración con vuelo de remonte obliga a estas aves a volar en grandes bandadas, lo que les limita el poder alimentarse. La aparente abundancia de alimentos disponibles para estas aves rapaces, excepto en condiciones de abundancia temporal, no ha sido observada. Consideramos que nuestras sugerencias, en cuanto a la migración en ayunas durante una distancia de 4000–5000 km y tal vez más, son razonables. Pese a la importancia de este tópico, aún no se tiene concreta información acerca de la reserva de grasa y agua en estas aves durante su migración.

LITERATURE CITED

ARAD, Z., I. GAVRIAELI-LEVIN, U. EYLATH AND J. MARDER. 1987. Effect of dehydration on cutaneous water evaporation in heat-exposed pigeons (*Columba livia*). *Phys. Zool.* 60:623–630.

BARTHOLOMEW, G.A. 1972. The water economy of seed-eating birds that survive without drinking. Proc. 15th Int. Ornithol. Congr., pages 237–254.

CHEREL, Y., J.-P. ROBIN AND Y. LEMAHO. 1988. Physiology and biochemistry of long-term fasting in birds. *Can. J. Zool.* 66:159–166.

LASIEWSKI, R.C., A.L. ACOSTA AND M.H. BERNSTEIN. 1966. Evaporative water loss in birds—I. Characteristics of the open flow method of determination, and their relation to estimates of thermoregulatory ability. *Comp. Biochem. Physiol.* 19:445–457.

SMITH, N.G. 1980. Hawk and vulture migrations in the Neotropics. Pages 51–65 *in* A. Keast and E.S. Morton [EDS.], Migrant birds in the Neotropics: ecology, behavior, distribution and conservation. Smithsonian Inst. Press, Washington, DC.

———. 1985. Some uncertain aspects of migration by Swainson's Hawks (*Buteo swainsoni*) and Turkey Vultures (*Cathartes aura*). Proc. North American Hawk Migration Conf., Rochester, New York.

———, D.L. GOLDSTEIN AND G.A. BARTHOLOMEW. 1986. Is long-distance migration possible for soaring hawks using only stored fat? *Auk* 103:607–611.

WEBSTER, M.D. AND J.R. KING. 1987. Temperature and humidity dynamics of cutaneous and respiratory evaporation in pigeons, *Columba livia*. *J. Comp. Phys.* 157:253–260.

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THREE POSSIBLE NEST-RELIEF FACTORS IN THE AMERICAN KESTREL (*Falco sparverius*)

JUAN ESTEBAN MARTÍNEZ-GÓMEZ
Av. 16 de Septiembre 1758, Veracruz, Veracruz 91900, Mexico

Balgooyen (1976) reported that male American Kestrels during incubation typically visited nests twice a day, once in the morning and once in the afternoon, and suggested that the male seemed to dictate the time of nest-relief. Olendorff (1968) could not predict nest-relief in kestrels because most of the times when the male presented himself, the female did not come out of the nest box. Although I noted a pattern of nest-relief behavior similar to that described by both Roest (1957) and Balgooyen (1976), I twice saw a female replace the male by entering the cavity. Here I report some cues that may influence nest-relief behavior in kestrels.