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Post-migration Weight Gain of Swainson's Hawks in Argentina

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ABSTRACT.—Swainson's Hawks (*Buteo swainsoni*; Aguilucho Langostero) were captured and banded in La Pampa, Argentina from 28 November 1996 through 25 January 1997. We collected morphometric measurements to determine if hawks gained weight on the austral (non-breeding) grounds. Hawks in apparently healthy condition weighed 819.7 ± 11.1 g (mean \pm SE, $n = 127$, range 540–1090 g). Weight increased significantly over the length of the non-breeding season in Argentina ($P = 0.0059$), but wingspan (124.9 ± 0.5 cm, $n = 127$, range 105.7–137.1 cm) and tail (19.8 ± 0.1 cm, $n = 127$, range 16.5–23.1 cm) did not. When separated by age, weight increased significantly for juveniles ($P = 0.0083$) but was marginally non-significant for adults ($P = 0.0555$). Received 15 Oct. 1998, accepted 15 Feb. 1999.

Swainson's Hawks (*Buteo swainsoni*) are long-distance migrants that travel between the plains, shrublands, and pampas (grasslands) of North and South America. During the southward migration, some hawks temporarily stop in Central America or in the agricultural zones of Mexico (Ridgely and Gwynne 1989, Stiles and Skutch 1989, Howell and Webb 1995). Occasionally some hawks are found in Florida (Robertson and Woolfenden 1992) and others winter in California (Herzog 1996). The pampas of Argentina are a major non-breeding (austral) destination, supporting much of this species' population from mid-November through early March. Two satellite radio-tagged hawks trapped by Brian Woodbridge in California in 1994 were tracked to La Pampa province, Argentina (Woodbridge et al. 1995). Large numbers of hawks were subsequently found in La Pampa, Buenos Aires,

and Cordoba provinces (Goldstein et al. 1996).

Adults feed primarily vertebrates to nestlings (England et al. 1997). Summer flocks of non-breeding birds eat a more varied diet, including insects (Johnson et al. 1987). On the non-breeding grounds, hawks are generally seen in large aggregations: roosting, foraging, and traveling together. In the pampas, the hawks primarily eat invertebrates (White et al. 1989, Jaramillo 1993, Woodbridge et al. 1995, Goldstein et al. 1996). The dietary shift allows for more birds to be supported per unit area. In La Pampa, flocks of birds following grasshopper (Orthoptera) outbreaks have been reported (Rudolph and Fisher 1993). We found flocks as large as 12,000 birds (Goldstein 1997).

Long-distance migration using only stored fat has been suspected but not documented (Smith et al. 1986). Whether hawks forage or fast en route to Argentina, or whether specific stopover habitats are regularly used is not known (Goldstein and Smith 1991, Kirkley 1991). The extent of predation on airborne dragonflies and other flying insects during migration is also unknown. Nevertheless, if migrating hawks used only stored fat they might arrive in the pampas in poor condition (Smith et al. 1986). Hawks have been reported arriving in Argentina in such weak condition that they were picked up by hand (C. C. Olrog in Smith 1980). None of these birds, however, were checked for contaminants.

Swainson's Hawks are found in Argentina from early November through mid-February, although later arrivals and earlier departures have been documented (England et al. 1997). Substantial periods of fasting during migration would result in a substantial loss of weight, weakened condition, and a subsequent increase in weight when on the wintering grounds. From November 1996 through January 1997, we captured and measured Swainson's Hawks on the non-breeding grounds. We

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present these data and observations regarding Swainson's Hawk austral weight gain.

METHODS

The research area in northern La Pampa (35° 14' S, 63° 57' W, 149 m ASL) is a flat grassland dominated by row crop agriculture. One hundred and twenty-eight Swainson's Hawks were captured and sampled in La Pampa from 28 November 1996 through 25 January 1997. Most hawks were trapped by bal chatri traps in open fields or on dirt roads between foraging fields (Bloom 1987). Nine of the 128 hawks were captured by hand after they were grounded from their nighttime *Eucalyptus viminalis* roost by a thunderstorm. All hawks were captured in the morning between 05:15 and 11:00 local time.

Hawks were banded and weighed to the nearest gram with a 1500 g Pesola scale. Wingspan and tail length were recorded to the nearest mm. Hawks were classified as juveniles or adults based on plumage, with immatures grouped as juveniles (Wheeler and Clark 1995). A regression analysis was used to analyze changes in weight, wingspan, and tail length for the population and for each age category. Time was expressed in number of trap days from Day 1 (28 November 1996). Because sexes could not be distinguished morphologically, we did not analyze the data by sex (Wheeler and Clark 1995). Statistical analyses were performed using SPSS 8.0 for Windows (SPSS Inc., Chicago, Illinois).

RESULTS

We collected complete data sets for 127 healthy hawks. One individual that might have been exposed to pesticides was excluded (Goldstein 1997). Weight averaged 819.7 g [± 11.1 (SE), range 540–1090 g]. Wingspan measured 124.9 cm (± 0.5 , range 105.7–137.1 cm), and tail length measured 19.8 cm (± 0.1 , range 16.5–23.1 cm). Regression analysis indicated that weight increased significantly over time ($R^2 = 0.0705$, $P = 0.0059$), but neither wingspan ($R^2 = 0.0001$, $P > 0.05$) nor tail length ($R^2 = 0.0078$, $P > 0.05$) increased during the season. This pattern suggested an increase in mass from late November until late January without structural growth.

There were 65 adult, 58 juvenile, and 4 unknown aged birds. Adults weighed 836.6 g (± 16.5 , range 560–1090 g). Juveniles weighed 794.2 g (± 15.9 , range 540–1080 g). Weight significantly increased over time for juveniles ($P = 0.0083$, $df = 57$, $R^2 = 0.1179$; Fig. 1A), but was marginally non-significant for adults ($P = 0.0555$, $df = 64$, $R^2 = 0.0570$; Fig. 1B). Although both age categories showed weight

gains, the larger slope for juveniles indicated they gained weight at a faster rate than adults. When examined by age, neither wingspan nor tail length changed over time ($P > 0.05$ for all).

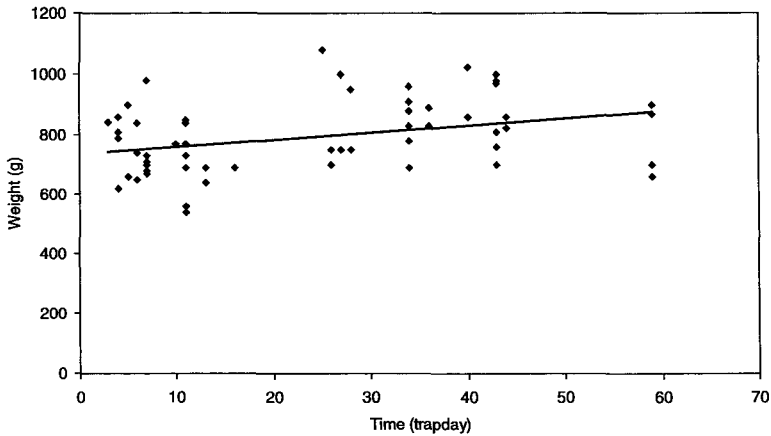
Wingspan was significantly and positively correlated with tail length ($r = 0.509$; $P < 0.05$) and with weight ($r = 0.342$; $P < 0.05$). Weight and tail length showed no correlation ($r = -0.048$; $P > 0.05$).

DISCUSSION

Swainson's Hawks remain in Argentina from mid-November through mid-February (Houston and Schmutz 1995, England et al. 1997). When we began following large flocks on 20 November 1996 we saw no signs of birds in poor condition. Whether birds arrived in Argentina in poor condition is uncertain, but neither our observations nor conversations with farmers supported that conjecture. Although hawks were not in poor condition when captured in late November, they were somewhat lighter than those measured on the breeding grounds. Breeding males weighed 808 g (range 693–936 g, $n = 69$) and females weighed 1109 g (range 937–1367 g, $n = 50$), for an overall mean of 934 g (J. K. Schmutz in England et al. 1997). Although hawks captured in Argentina averaged 819.7 g, birds captured on 28 November–17 December 1996 were notably lighter (779.1 g) than the mean. Hawks captured from Days 21–59 weighed 860.5 g. Both adults and juveniles, when examined separately, show similar patterns of weight for Days 1–20 (adults 814.8 g, juveniles 737.0 g) and Days 21–59 (adults 872.5 g, juveniles 847.7 g). This pattern suggests that both adult and juvenile hawks lost weight during migration and then regained it during their stay in Argentina, although the trend for juveniles was stronger. However, if the hawks foraged in the northern pampas for several days or weeks prior to their arrival near the La Pampa field sites, our measure of weight loss is underestimated.

Rectrix lengths were consistent with those reported from North America (England et al. 1997). Alberta males averaged 18.4 cm (range 17.0–19.8 cm, $n = 61$) and females averaged 20.5 cm (range 19.3–22.1 cm, $n = 43$) for an overall length of 19.3 cm (J. K. Schmutz in England et al. 1997). We found no wingspan

A.



B.

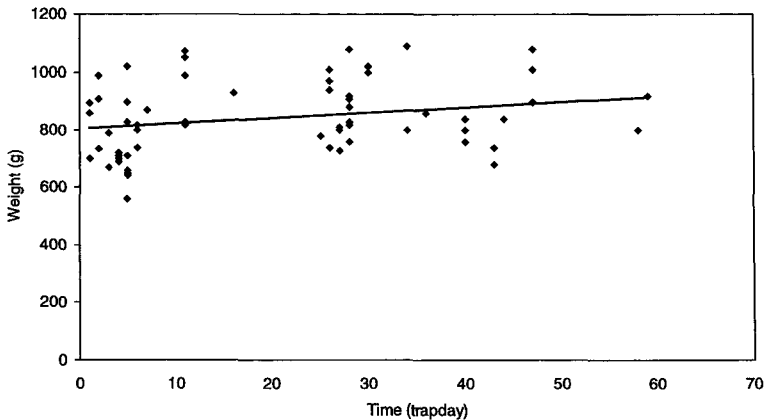


FIG. 1. Swainson's Hawk juvenile (A) and adult (B) austral weights from 28 November 1996 through 25 January 1997 as measured in northern La Pampa, Argentina. Juvenile weight gain was significant ($Y = 2.3972x + 736.65$, $R^2 = 0.1179$, $n = 58$, $P = 0.0083$). Adult weight gain was marginally non-significant ($Y = 1.8196x + 806.89$, $R^2 = 0.0570$, $n = 65$, $P = 0.0555$).

data for North American hawks in the literature. In addition, hawks were molting throughout the non-breeding season in Argentina, a phenomenon that has not been studied.

We captured only one hawk that was light weight and appeared weak. The hawk weighed 560 g when trapped on 25 November 1996. It gained 100 g in 5 days of captivity and was subsequently released. Whether this bird was weak from migration or had been

exposed to toxins is unknown. Although no chemical residues were found on either foot-wash or feather residue samples, cholinesterase measurements from blood plasma samples taken at the time of capture were 30% below those taken at the time of release (Goldstein 1997). Exposure to organophosphate insecticides decreases plasma cholinesterase activity levels (Hill and Fleming 1982).

Large flocks foraging on the ground during

migration were thought unlikely in the past (Smith et al. 1986), but such behavior may not be uncommon (see England et al. 1997, Goldstein 1997). Insect outbreaks in agricultural grasslands may provide terrestrial foraging opportunities along the migration corridor. Recently discovered populations wintering in southwestern Mexico confirm the need for further study of stopover habitats. In addition, hawks are known to forage aerially for grasshoppers and dragonflies across the pampas of Argentina (White et al. 1989, Jaramillo 1993, Rudolph and Fisher 1993, Woodbridge et al. 1995, Goldstein 1997). We have no idea what altitudes are reached while traveling on thermal air currents across the insect-rich tropical and sub-tropical rainforests, nor whether any appreciable distance is ever achieved without aid of thermals. We do not know whether aerial insects are in adequate supply at the heights of travel. The question of the duration and extent of fasting of Swainson's Hawks during migration needs further study although lengthy periods of fasting seem unlikely given the weights of November birds captured in Argentina.

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Siblicide at Northern Goshawk Nests: Does Food Play a Role?

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ABSTRACT.—Siblicide as a mechanism for brood reduction has been reported in a number of asynchronously hatching bird species. Although researchers have documented the occurrence of facultative siblicide in several raptor species, its cause is still debated. Most hypotheses relate incidences of siblicide to food availability. The food-amount hypothesis predicts a negative relationship between the amount of food available and nestling aggression. While the food-amount hypothesis has received much attention, few studies show more than correlational support for this activity in raptors. Our observation of a siblicide event at a Northern Goshawk (*Accipiter gentilis*) nest used as a control in a supplemental feeding experiment, and a similar incident where a nestling goshawk's death can be attributed to siblicide provide support for the negative correlation between food amount and sibling aggression. These observations and the lack of any reported sibling aggression at seven supplementally fed nests showing extreme hatching asynchrony also indicate a relationship between food resources and brood reduction. Our observations are consistent with the idea that goshawks exhibit facultative siblicide, and that resource levels as predicted by the food-amount hypothesis directly influence it. *Received 7 Oct. 1998, accepted 16 Feb. 1999.*

ling is at a competitive disadvantage if resources provided by the parents prove inadequate. In asynchronously hatched broods, the youngest nestling occasionally dies from aggressive sibling behavior including pecking, exclusion during feeding bouts, or eviction from the nest (Lack 1954, Mock et al. 1990, Creighton and Schnell 1996). Asynchronous hatching results in adapting a brood size to an unpredictable food supply by allowing all young to survive when food is plentiful, but ensuring brood reduction to match parental provisioning capabilities when prey levels are meager (Lack 1954, Newton 1979, Bryant and Tatner 1990, Heeb 1994). Species in which the frequency of siblicide events are variable are termed facultative, while those in which siblicide occurs in nearly all nest attempts are called obligate (Edwards and Collopy 1983). Although the occurrence of obligate siblicide appears to be largely innate (Mock et al. 1990, Gerhardt et al. 1997), the causes of facultative siblicide are still debated (Forbes and Mock 1994).

Hatching asynchrony in birds facilitates brood reduction because the last hatched nest-

Fatal sibling aggression has been documented in a range of avian species (Stinson 1979, Braun and Hunt 1983, Anderson 1989, Drummond and Garcia Chavelas 1989, Bryant and Tatner 1990, Mock et al. 1990, Mock and Lamey 1991, Heinsohn 1995, Reynolds 1996). However, an understanding of the proximate factors that influence the occurrence of facultative siblicide remains elusive because such events are rare and unpredictable. Most similar hypotheses attempt to explain facultative siblicide in relation to food.

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