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NEST SITE RELATIONSHIP BETWEEN THE FERRUGINOUS HAWK AND SWAINSON'S HAWK

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The objective of this report is to document and explain an interspecific nesting relationship we observed between sympatric buteos: the Ferruginous Hawk (*Buteo regalis*) and the Swainson's Hawk (*Buteo swainsoni*). Mutual defense behavior by pairs from closely associated nests became strikingly apparent in the course of conducting an intensive study on the Ferruginous Hawk and its tolerance to human activity (Thurow et al. 1980, White and Thurow unpubl. data).

METHODS

Study area.—The study area was in Raft River Valley of Cassia County near the town of Malta, southcentral Idaho. The region's physiography and climate are typical of the Great Basin cold desert (Odum 1971). The vegetation of the valley is characteristic of the northern desert shrub-biome as delineated by Cronquist et al. (1972). Juniper (*Juniperus osteosperma*) grows along the sides of the mountains and in intermittently moist drainages which extend into the valley. The valley vegetation was dominated by big sagebrush (*Artemisia tridentata*). Our research effort was concentrated along the continuous sagebrush/juniper ecotone.

Both Ferruginous and Swainson's hawks were common in the valley and favored large junipers located along the rangeland ecotone for nesting. The tree chosen for a nest site typically was near the ecotone interface and, in the case of the Ferruginous Hawk, had a characteristic flat-topped appearance. This was in contrast with the relatively scarce Red-tailed Hawk (*Buteo jamaicensis*) which primarily chose nest sites in lombardy poplar (*Populus nigra*).

Procedure.—The area within a .8 km (.5 mi was originally chosen as the area to check) radius around 15 randomly chosen (from a table of random numbers) active Ferruginous Hawk nests was examined for possible Swainson's Hawk nesting activity during the 1978 and 1979 breeding seasons. Ferruginous Hawk nests were used as the focal point of searches because their nests are bulky, conspicuous structures that are used annually and easily found. In contrast, Swainson's Hawks build smaller nests that are not necessarily reused and are often concealed within the tree canopy. Therefore, to locate Swainson's Hawk nests, we inspected each individual tree. As a control, the same procedure was used around 15 Ferruginous Hawk nest sites that were not currently active, but may have been 1 to 2 years previously. Land use and the relative degree of human disturbance remained constant at these sites and was not the cause for occupancy change.

RESULTS AND DISCUSSION

In 1978, 14 out of 15 (93%) active Ferruginous Hawk nests had an active Swainson's Hawk nest within .8 km ($\bar{x}$ = .6 km, range .32–.80 km). In 1979, search areas were again randomly selected and 11 out of 15 (73%) active Ferruginous Hawk nests had an active Swainson's Hawk nest within .8 km ($\bar{x}$ = .57 km, range .32–.80 km). In contrast, only 3 of 15 (20%) active Swainson's Hawk nests were located within .8 km ($\bar{x}$ = .42 km, range .35–1.7 km) of an inactive Ferruginous Hawk nest in 1978 and 4 of 15 (27%) ($\bar{x}$ = .53 km, range .4–.8 km) in 1979. Nesting Swainson's Hawks were significantly associated (χ^2 = 16.4, 1 df, $P \leq$ .005) with active Ferruginous Hawk nest sites within a sample radius of .8 km. Most of the census areas around inactive Ferruginous Hawk nests contained a cluster of inactive Swainson's Hawk nests. As a further example of this close association, 2 active Swainson's Hawk nests were located in the routine course of traveling within the valley. Near one, a previously unknown active Ferruginous Hawk nest was found .8 km away. At the other, an active Ferruginous Hawk nest was found in the nearest suitable tree which happened to be 1.3 km away. In this latter case, trees closer to the Swainson's Hawk nest neither contained old Ferruginous Hawk nests nor were they of the characteristic size and shape typically selected by this species.

While a nest site relationship between the Ferruginous and Swainson's hawk is statistically implicit, the reasons for such an association are not as apparent. As summarized by Newton (1976) at least 9 factors, some environmental and some populational, may act to control nest-site placement in raptors; not all of these can be closely examined because of the difficulty of obtaining reliable data. The environmental factors include: (1) food availability near potential nest sites; (2) quality of nest; (3) overall scarcity of sites in area, and (4) absence of disturbance, predation, or competition at nest sites. Population factors include: (1) population density in area; (2) degree of sociality; (3) distance to nearest occupied nest; (4) historical success at nest site, and (5) percentage of older adults in population. Several possible reasons that are testable include: (1) placement of trees in a clumped or other nonuniform pattern that influence nest placement; (2) a function of distance between nearest neighbor species whether conspecific or not; (3) food availability in poor or good prey years; (4) timing of arrival of the respective species; (5) simple response to local patterns of several variables in concert, and (6) some mutualistic relationship.

The problem of tree availability and distribution can be dismissed readily, since trees formed a more or less continuous band along the foothills. Although trees of certain shapes or structures were characteristically selected, Ferruginous Hawk nests were regularly spaced around the valley at an average of 4.3 ± 1.0 km (n = 19) in 1978 and 3.8 ± .8 km (n = 25) in 1979 (Thurow et al., 1980). Swainson's Hawks arrived about a month after Ferruginous Hawks had established territories. The Swainson's Hawks appeared to cue in on the Ferruginous

Hawks, not the reverse. Schmutz et al., (1980) also noted that Ferruginous and Swainson's hawks nested in close proximity despite available unoccupied nests in trees farther away. Such associations are not unprecedented in cases where one species is larger and establishes its breeding site prior to the smaller species. This has been documented for the Little Gull (*Larus minutus*) that nested adjacent to the larger, earlier nesting Black-headed Gull (*L. ridibundus*) (Veen 1980). While it is difficult to document what advantage the Little Gull gained by seeking out other gull colonies and moving colony areas coincidentally with the other species, it nonetheless occurred.

Both the Ferruginous and Swainson's hawk generally tolerated each other's presence providing the actual nest sites were not closely approached. On 19 occasions when the investigator approached the nests of one species, a member of the other species was first to appear and give the alarm calls. This action may have alerted the absent pair to impending danger earlier than they would have otherwise detected it. In 13 instances this cooperative defense was extended to the point that Swainson's Hawks stooped at an investigator climbing to a Ferruginous Hawk nest. We did not encounter this stooping behavior in the reverse situation, although Ferruginous Hawks often circled low and screamed at the investigators near Swainson's Hawk nests. Often during these instances both pairs eventually arrived and, while soaring together, concentrated their attention on the terrestrial intruder. Such a combined attack was observed 8 times when directed against an intruding Golden Eagle (*Aquila chrysaetos*). In these instances members of both pairs took successive stoops at the eagle, but never against each other, though sometimes flying close together. The Ferruginous Hawk can be aggressive against mammalian predators other than man, and we are aware of cases when canids approaching too close to a Ferruginous Hawk nest have been injured by the adult attacks. It appears plausible that defense of the common nesting territory by both pairs affords a greater protection of the nest than could be provided by only one pair.

It should be expected that the benefit of such protection be quantifiable in such variables as reproduction. There was, however, no difference in fledging rates of those species pairs nesting near each other versus solitary nesters, although the sample size for the latter is small. Schmutz et al. (1980) showed that for the Canadian prairies the threshold distance between the nearest nesting congener below which reproduction was reduced was $\leq .2$ km for Swainson's Hawk and $\leq .3$ km for Ferruginous Hawk. They suggested that competition for space produced this lower reproduction. In no case could we find nests that were $\leq .2$ km apart, which might explain why we were not able to find lowered fledging rates. With both species in the Canadian study having greater than 80% diet overlap, we suggest that diet, in addition to space, may be a contributing factor to lowered reproduction. We also suggest that this might be tested where diet overlap is less than 80% as in our study area (see beyond) and where nests are $\leq .2$ km apart.

Another possible reason for the nest site association may be due to uneven prey distribution. It is possible that Swainson's Hawks (which arrived much later at the breeding site and consequently had to quickly initiate breeding activities) chose the area because of higher prey densities or the presence of Ferruginous Hawks indicated a high prey density. Such a theory is not tenable in this case. Prey densities were high on the entire study area. The black-tailed jackrabbit (*Lepus californicus*) summer population was estimated to be at a near peak density of about 300 per km^2 (Thurow et al. 1980) using the flushing distance equation of Hayne (1949) and the correction factor and census criteria of Gross et al. (1974). A concurrent investigation in the study valley determined a small mammal density of 259 per ha^2 (D. Landeen, pers. comm.). The population of nesting desert bird species was average for such desert plant communities (unpubl. data).

Prey items we found at the nest sites showed moderate differences between the species. The Ferruginous Hawks' diet consisted mainly of black-tailed jackrabbits, northern pocket gophers (*Thomomys talpoides*) and Townsend's ground squirrels (*Spermophilus townsendi*), while Swainson's Hawks took fewer individuals of these species and more birds and insects (Thurow et al. 1980). Kulczynski's Index of Similarity (cf. Ueckert and Hansen 1971) was used to measure the amount of overlap in prey taken by the Swainson's Hawk and Ferruginous Hawk. On a biomass basis the 4 most common mammals in the Ferruginous Hawk diet (94.2% of total) had an index of similarity of 64.5 when compared with the main 4 prey items of the Swainson's Hawk. On a numerical basis of individuals taken in the diets, the index of similarity was 55.8 for mammals, 71.9 for birds, and 52.4 for the entire diet. These indices suggest that the degree of overlap is not great, and that food is not the reason for the association of the species. This may be less true in regions such as Alberta, where dietary overlap was between 80% and 98% depending on the year (Schmutz et al. 1980). Hunting interaction between the species, even when the prey is essentially the same, would be partially limited due to the somewhat separate hunting periods (cf. Smith and Murphy 1973). The possibility of Swainson's Hawks cueing in on Ferruginous Hawks on the basis of the latter's selection for a local food abundance could be tested, but not easily. Ferruginous Hawks that had already selected territories could be removed prior to the arrival of the Swainson's Hawk. If the Swainson's Hawks selected the same area as the Ferruginous Hawks had previously selected, then one might suppose the area is being selected irrespective of the presence of the other hawk.

In addition to these factors, the large hunting territory used by both species and the abundant prey base make nest site selection on the basis of localized food supply unlikely. Both species appeared to use common hunting areas that were away from the nest and were used by several pairs. Ferruginous Hawks did not use a series of regular plucking perches. Consequently, Ferruginous Hawks would not be a constant supplier of wasted food scraps for Swainson's Hawks as may be the case in the

nesting relationship between the Prairie Falcon (*Falco mexicanus*) and the Common Raven (*Corvus corax*). The close association between Prairie Falcon and Raven nest sites may also enable better nest protection through defense of the general nesting territory by both species (cf. Dawson 1923).

Our findings suggest that the mutualistic defense behavior of the shared nesting ranges may be a primary reason for the proximity of nests we found for Ferruginous and Swainson's hawks. This association would be beneficial for both species by increasing their defense capability against potential predators.

In areas not providing habitat as uniform as the sagebrush/juniper ecotone, such a relationship may not be as conspicuous, but should nonetheless be looked for. For example, in the areas studied by Olendorff and Stoddard (1974) and Fitzner (1979), especially for the Swainson's Hawks, the spotty distribution of patches of trees or the limited area of those patches, may be the primary factor in determining nesting distribution.

SUMMARY

In a sagebrush/juniper ecotone area of southcentral Idaho, we found nesting Ferruginous and Swainson's hawks to be significantly associated in their nest placement. Swainson's Hawks constructed nests within an average of .6 km of the earlier nesting Ferruginous Hawk and compared to random placement this association was significant ($P \leq .005$). We examined placement of trees, distribution and abundance of food, timing of arrival on the breeding grounds, and a mutual territory defense as possible causes for this relationship. We suggest that the data may be best explained as a response associated with nest protection.

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