J. Field Ornithol., 60(3):323-328

INTERFERENCE BY HOUSE SPARROWS IN NESTING ACTIVITIES OF BARN SWALLOWS

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Abstract.—We document occurrences of House Sparrows (*Passer domesticus*) interfering with Barn Swallow (*Hirundo rustica*) nests during the breeding seasons of 1978–1981. Interference took three forms: (1) removal of the nest lining, (2) removal or pecking of eggs, and (3) removal or pecking of nestlings. House Sparrows removed the nest lining from nests on six occasions, and were responsible for 20 deaths of nestling swallows. We suspect sparrow involvement in 15 other deaths of nestling swallow and 42 broken swallow eggs. We did not observe intraspecific interference (infanticide), although it may have been the cause of some egg losses and nestling deaths. Sparrow interference reduced the reproductive output of the colony by 44.7% over the 4 yr of the study. We suggest that sparrow interference is nonadaptive in this instance as no benefits to the sparrows were observed.

INTERFERENCIA DE *PASSER DOMESTICUS* EN EL ANIDAMIENTO DE *HIRUNDO RUSTICA*

Resumen.—En este trabajo se documenta la interferencia del gorrión *Passer domesticus* en el anidamiento de la golondrina *Hirundo rustica.* Los gorriones interfirieron de tres formas: (1) removiendo material de anidamiento, (2) picotendo o removiendo huevos y (3) picoteando o removiendo pichones de los nidos. Los gorriones removieron material de anidamiento en 6 ocasiones y fueron responsables de la muerte de 20 pichones de las golondrinas. Se sospecha que los gorriones estuvieron además envueltos en otras 15 muertes de pichones y en la destrucción de 42 huevos. No se observó interferencia intraespecífica (infanticidio), aunque se sugiere que puede haber sido la causa de perdida de huevos y mortandad de pichones. En cuatro años de estudio (1978–1981) la interferencia por parte de los gorriones, redujo la productividad de las golondrinas en 44.7%. Los autores sugieren que la interferencia muy bien podría ser no adaptativa, ya que aparentemente los gorriones no deribaron beneficio de esto.

Interspecific competition may be exploitative competition, where individuals preferentially use a resource thereby depriving others of its benefits, or interference competition, where an individual's activities prevent use of a resource by other individuals (Diamond 1978, Maurer 1984, Schoener 1983). Examples of such interference are fighting, producing toxins, and nest destruction (Maurer 1984, Schoener 1983). In either form, competition establishes a priority of resources.

As a form of interference competition, nest destruction is less costly than fighting in both energy and time, and is less likely to injure the aggressor (Diamond 1978). Nest destruction has been reported for species in several families: Hirundinidae (Brown 1984), Troglodytidae (Anderson and Anderson 1973; Belles-Isles and Picman 1986; Picman 1977, 1984; Picman and Picman 1980), Mimidae (Belles-Isles and Picman 1986, Bowman and Carter 1971), Icteridae (Creighton and Porter 1974, Verner 1975) and Ploceidae (Jackson and Schardien Jackson 1985, Jackson and Tate 1974, Krapu 1986, Olmstead 1955).

The benefits of nest destruction are variable. In some examples, aggressors usurp nests of victims immediately (Olmstead 1955) and benefits are apparent. Similarly, where limited nest sites exist, i.e., for hole nesting species, suitable or more desirable nest sites are benefits of nest destruction (Belles-Isles and Picman 1986). Interfering species can destroy eggs and young nestlings of potential competitors thus promoting temporal and spatial segregation of resource demands as the interference recipient must replace the lost clutch or nest elsewhere (Creighton and Porter 1974). Some species devour nest contents, thus food is a benefit (Creighton and Porter 1974). Nest destruction may also be a means of reducing aggression on oneself or one's nest when two species practice mutual nest destruction as with Marsh Wrens (*Cistothorus palustris*) and Yellow-headed Blackbirds (*Xanthocephalus xanthocephalus*) (Verner 1975).

Nest destruction by House Sparrows (*Passer domesticus*) occurs commonly in interspecific interactions (Jackson and Schardien Jackson 1985, Jackson and Tate 1974, Krapu 1986, Olmstead 1955). Although House Sparrows have an impact on other species' nest success (Krapu 1986) and nest availability (Jackson and Tate 1974), benefits of interference are not always apparent (Jackson and Schardien Jackson 1985). This paper documents three forms of nest destruction by House Sparrows on Barn Swallow (*Hirundo rustica*) nests, and suggests possible causes for interference competition by sparrows.

METHODS

This study was carried out in a barn located 10 km NE of Bel Air, Maryland (Long. 76°16′, Lat. 39°35′) during summers of 1978–1981. Observations of swallow nests were made by two methods: (1) direct observation from a blind 3–5 m from a nest, and (2) a Minolta Super-8 movie camera attached to a microswitch-tripwire arrangement set so any bird arriving at the nest was photographed. Nest contents were monitored twice daily by direct inspection. In this paper all information on swallows will be the mean for all swallows studied.

RESULTS

Barn Swallow mortality did not differ significantly between: (1) study years (Table 1), (2) broods (Barn Swallows generally produce two clutches/yr), (3) clutch size, and (4) order of hatching.

Sparrow attacks on swallow nests took three forms: (1) removal of actual nest material, (2) pecking of eggs, and (3) removal or pecking of nestlings. The first form of interference, removal of nesting material, was directly observed six times on 28 Jun. 1981. In each case, a swallow brought a feather to the nest and incorporated it into the lining. The swallow departed and a sparrow removed the feather and placed it in its own nest, which was approximately 3 m away.

Evidence of sparrows pecking eggs is limited to one film showing a male sparrow in a swallow nest at two different times on 10 Jun. 1981. The nest contained four eggs at the time. In both cases, adult swallows returned to the nest and drove the sparrow away.

TABLE 1. Barn Swallow nesting results, 1978–1981.

Number of:	Year				Total
	1978	1979	1980	1981	
Nests	11	22	21	15	69
Nests attacked	3	8	7	6	24
Eggs laid	54	97	86	67	304
Eggs hatched	45	89	75	50	259
Young fledged	35	78	60	42	215
Losses due to:					
House Sparrow*	3	4	7	6	20
Probable Sparrow					
Eggs	2	4	7	2	15
Young	9	7	9	17	42
Other					
Ectoparasites	0	3	0	0	3
Starvation	1	0	1	0	2
Weather	4	0	0	0	4
Infertility	0	1	2	0	3
Total loss	19	19	26	25	89

* Nestlings only.

Egg loss occurred continuously during the study. When nest inspection showed a reduction in eggs from the previous day, eggs could often be found on the ground within 7 m of the nest. These eggs and occasionally ones still in nests had holes pecked in them, but no noticeable amount of fluid removed, suggesting that the eggs were not opened for food.

An example of sparrows removing nestling swallows from a nest was filmed on 25 Jun. 1979. An adult male sparrow arrived at a swallow's nest and began pulling a nestling from the nest. Several minutes passed before the sparrow succeeded in removing the nestling which clung to the nest and then to the camera tripwire before falling to the ground. Both swallow parents arrived at this time and chased the sparrow away. No other nestlings were taken from this nest.

Other examples show even greater sparrow persistence. On 10 Jun. 1980 a male sparrow removed two nestlings from a nest in the morning and two more from the same nest that afternoon. A male sparrow attacked a nest on 9 Jun. 1980, removed one nestling and pecked the four remaining young. On 12 Jun. 1980 a sparrow removed the remaining nestlings from this nest.

DISCUSSION

The impact of interference on a breeding swallow pair varies with the type of nest destruction. Sparrow theft of nest material probably does little more than raise swallow energy expenditure by the amount required to replace the material taken. At the extreme the possibility exists that if the nest lining is not replaced and is therefore thinner than normal, the insulating value of the nest would be decreased. This would increase energy expenditure during incubation and brooding, and increase nestling energy loss.

The consequences of egg loss from a nest depend on when eggs are taken. If eggs are taken during the laying sequence they may be replaced with only the energetic cost of the egg and its laying. If eggs are removed after the laying sequence is over, they are not replaced and the possible number of offspring is reduced accordingly. However, more than just one egg was usually taken, and the loss of the entire second brood must be added to the replacement cost of eggs from the first brood (so much time and energy may be required for replacing the lost clutch that a second clutch is impossible). This situation occurred in at least five nests during the study. If sparrows continue to peck eggs, swallows may abandon the nest and establish another elsewhere in the barn. This also reduces their reproductive output to one clutch instead of two.

The impact of nestling injury or death from sparrow interference on the individual pair is obvious. Injured nestlings may require more energy and a longer nestling period as their growth rates may slow during the healing period. Injured birds may also have a higher post-fledging mortality rate than uninjured birds. All energy and time invested in a slain nestling is lost. Furthermore dead nestlings represent a lowered reproductive output and thus decreased fitness.

How sparrow interference affects the resultant swallow population also varies with the type of nest destruction. Theft of nest material probably has little effect on a swallow population.

Because of the complex of production-associated costs, the effect of egg loss is not easily measured. In some cases interference caused entire second clutches not to be laid, and in other cases the actual number of eggs lost in a nest exceeded the maximum clutch size. Of the total number of 304 eggs laid, 42 (13.8% of total) were either broken or disappeared from nests. Circumstantially, sparrows were likely culprits in egg removal. In this population, five swallow pairs produced only one clutch due to first clutch egg destruction. If these swallows had produced a second clutch, each with the mean clutch size of 4.4, then 22 more eggs could have been laid. When these 22 eggs are added to those that were damaged or lost the number of unhatched eggs attributable to interference becomes 64.

Nestling death caused by known or suspected sparrow interference totalled 35. When nestling death is added to the number of unhatched eggs and adjusted for the non-sparrow mortality rate of 3.5%, 96 additional swallows could have been produced without sparrow interference. These 96 possible young represent a 44.7% increase in reproductive output by the colony during the study period. This increase is below that found by Krapu (1986) when he removed sparrows from a Cliff Swallow colony for a three year period.

Barn Swallows are known to exhibit intraspecific interference via infanticide (Crook and Shields 1985, Møller 1987). Infanticide caused 16.3% of the nestling mortality in Crook and Shields' (1985) population and affected 4.9% of Møller's (1987) nests. We did not mark adult birds in our study so intraspecific interference could not be established. We did not observe infanticide nor was it obvious in our films. In our cases of suspected sparrow interference, nestlings were 1–14 d old; all known or suspected cases of infanticide occurred when nestlings were less than 5 d old (Crook and Shields 1985, Møller 1987). We do allow that some of our suspected sparrow interference may have been from intraspecific infanticide.

The specific benefits sparrows garner from interference with Barn Swallows are unclear, and no conspicuous resource priority is established. During this study, no sparrow used a swallow nest that had been previously attacked. Additionally, at no time were all available swallow nests being used. This suggests that nests were not limited and not the cause of sparrow interference. The number of active swallow nests increased from 15 in 1978 to 23 in 1981 while the number of sparrow nests increased from 1 to 6 during the same period. There was not, however, an increase in nest destruction. If interference served a competitive function for sparrows in the barn, then destruction should have increased with increasing density.

If House Sparrows have evolved nest destruction as a means of gaining access to nest sites when sites were limited, they may be unable to "turn off" this trait in situations where nest sites are not limited and interference is not beneficial. For selection to eliminate a trait that has little cost associated with it would require considerable time, much more than that required to adapt to nesting in man-made structures with ample nesting sites for sparrows. For this trait to be removed from a population would also require it to be disadvantageous more often than advantageous. Except for the time and energy costs associated with nest destruction, sparrows are clearly disadvantaged little. House Sparrow interference in this barn may be a case where what is generally advantageous is not necessarily beneficial in all specific situations.

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Received 25 Apr. 1988; accepted 1 Oct. 1988.

NOTES AND NEWS

HAWK MOUNTAIN-ZEISS RAPTOR RESEARCH AWARD

The **HAWK MOUNTAIN SANCTUARY ASSOCIATION** awarded its 1989 research grant to SUZANNE M. JOY, a M.S. candidate at COLORADO STATE UNIVERSITY. Her project is entitled "Nest-site characteristics and foraging behavior of Sharp-shinned Hawks in mature aspen and conifer habitats."

The Hawk Mountain Sanctuary Association is now accepting applications for its thirteenth annual award to support student research on birds of prey. Support for this award is provided by Carl Zeiss Optical, Inc. Up to $2000 in funds are available and will be awarded to one or two recipients. To apply, a student applicant should submit a brief description of his or her research program (five pages maximum), a *curriculum vitae,* a budget summary including other funding anticipated, and two letters of recommendation to **DR. JAMES C. BEDNARZ,** *Hawk Mountain Sanctuary Association, Rte. 2, Kempton, Pennsylvania 19529, USA.* The deadline for applications is **15 November 1989**. The Association's board of directors will make a final decision in February 1990. Only undergraduate and graduate students in degree-granting institutions are eligible to apply. The awards will be granted on the basis of the project's potential to improve understanding of raptor biology and its ultimate relevance to the conservation of raptor populations. The funds are no longer restricted to studies in North America and applications from anywhere in the world will be considered.