

KIN ASSOCIATION, SPACING, AND COMPOSITION OF A POST-BREEDING ROOST OF PURPLE MARTINS

BY EUGENE S. MORTON AND ROBERT M. PATTERSON

Young Purple Martins (*Progne subis*) return to natal colonies from 1 to 12 (ave. 4.9) days after fledging, but it is uncommon for martins to continue using nesting houses for roosting long after young are independent at ca. 7 to 10 days post-fledging (Brown 1978). Instead, young and adults usually congregate in large pre-migratory roosts in trees and/or on power lines (Allen and Nice 1952, pers. obs.).

However, near Annapolis, Maryland, martins annually have used a breeding colony for roosting until 18-25 August, well past fledging and independence of the young. All young and most adults in this colony have been banded since its establishment in 1976, and we could thus distinguish birds foreign or native to the colony. We here analyze kin association and the spatial use of the compartments for roosting.

METHODS

The colony consisted of two 24-compartment and one 12-compartment aluminum martin houses (Trio Manufacturing Co.), each mounted on a metal pole arranged ca. 3m apart forming a triangle. All compartments were numbered.

In 1981, the 109 young (fledged from 27 broods) were color-banded red over blue with numbered blue bands. Each brood was thus identifiable as was their natal compartment, natal house, and approximate fledging date. Foreign birds (not hatched or breeding at the study colony) were recognized as being unbanded or by having bands not used at this colony.

Martins were counted on 30 July and 1-2 August 1981 while they perched on utility wires prior to roosting in the houses. The counts ranged from 135 to 158 and ca. 50% were unbanded. On 3 August, at 21:30, we captured all martins roosting in the 3 houses using wooden panels attached to string pulleys as trapdoors (Patterson, unpublished data). The birds roosting in each compartment were sexed (adults) and aged (U.S.F.W.S. and C.W.S. 1977). Two unfledged broods of 4 remained in one house and are not considered in the compilations. Also, 3 compartments were not available for roosting due to premature closing of the trapdoors. The trapping apparently caused the abandonment of the roost, for none returned to roost on 4 August.

On 12 July 1981, we had used the same method to capture breeding adults. There were 29 active nests but we caught only 34 adults since a few escaped and others roosted away from the houses. Those captured with unfledged young were assumed to have nested in that compartment. Subsequent observations of banded adults feeding nestlings validated this assumption.

All 3 houses had been dusted with sevin and no martin mites (*Der-*

TABLE 1. Frequency of HY Purple Martins roosting at natal colony relative to age post-fledging.

Days post-fledging	No. in age class	No. present	% present
4 ^a	6	6	100
7 ^a	37	24	65
12-13 ^b	10	6	60
14 ^a	56	31	55
16 ^b	10	5	50
18 ^b	5	2	40
22-27 ^b	28	0	0

^a Data from Annapolis (primary) study site.

^b Data from Sandy Point State Park, Md. studied by Patterson, 6 August 1981, using the same technique as with ^a.

manysus prognephilus) were present to possibly influence the birds choice of roosting sites.

RESULTS

One-hundred-fifty-five martins were captured and distributed as follows: juveniles (HYs) (137; 89%), 1st yr. females (SY-F) (6; 4%), 1st yr. males (SY-M) (5; 3%), 2nd yr. + females (ASY-F) (5; 3%), and 2nd yr. + males (ASY-M) (2; 1%). It is possible that all adults captured had bred at the colony, since some breeders had not been banded, but of the 18 adults, 9 were known breeders at the study colony. Of the HY birds, 74 (54%) were native and 63 (46%) were foreign. Five of the latter were previously banded but not at the study site. One was banded at a colony less than 2 km away, one 13 km ESE, two 13 km WSW, and one 27 km NW from the study colony.

Foreign birds concentrated in the center of the 3 houses ($\chi^2 = 8.6254$, $df = 2$, $P < .02$). Native birds were distributed randomly among the houses ($\chi^2 = 1.1026$, $df = 1$, $P < .2$). We found no association for native HYs between natal compartment or house and their location in the roost ($\chi^2 = 0.7986$, $df = 2$, $P < .5$). Data were insufficient to test for adults, but 8 of 9 were roosting in the houses they had used for nesting and 4 of the 8 were in the compartment in which they had nested.

The 5 banded foreign HY birds were all over 20 days post-fledging, suggesting that HY martins may break any bond with their natal colony after reaching complete independence from parental care. To look for an age-related association of HY martins with their natal colony, we compared the proportion of native HY martins roosting at natal colonies and found support for the suggestion that HY martins disperse from natal colonies gradually (ca. 5% per day after independence) (Table 1).

Kin associations also appear to break down rapidly post-fledging. Table 2 shows little association among siblings or between parents and

TABLE 2. Distribution of native birds on 3 August relative to compartment and house fledged from or nested in.^b

House	Nesting compartment	Brood size	No. roosting 3 Aug.	Location 3 Aug. House (compartment.)	Adults roosting 3 Aug. (Location of nest site) ^a
A	1	5	2	A(10), B(3)	ASY-F(U), SY-F(C,1)
	2	4	4	A(18), B(1, 19), C(8)	ASY-F(A,2)
	5	5	0		SY-F(A,22)
	6	5	5	A(5, 9, 9), B(17), C(9)	
	7	2	2	A(13), C(11)	
	10	3	3	A(5, 10), B(10)	SY-M(A,10)
	11	4	2	A(6, 14)	
	13	4	3	A(7, 9, 13)	
	14	—	—		SY-F(A,10)
	17	3	3	A(17, 17, 17)	ASY-F(A,17)
	21	2	0		
	22	4	2	A(13), B(17)	ASY-F(A,6)
	23	4	1	B(18)	
	24	4	1	B(14)	
B	1	3	2	A(13), B(14)	
	3	—	—		SY-M(U)
	4	—	—		SY-M(U)
	6	5	4	A(5, 6, 22), B(10)	
	9	3	3	A(7), B(9, 9)	SY-M(U)
	13	4	0		
	14	4	2	A(5), B(18)	
	17	4	0		ASY-M(U)
	20	2	2	A(19), B(6)	
	21	4	4	B(12, 15, 18, 18)	ASY-M(B,21)
22	3	3	A(10), B(9, 17)	SY-M(U), SY-F(U), SY-F(U)	
C	1	4	4	A(19), B(6, 10), C(2)	
	4	4	4	A(2), B(11), C(7, 7)	
	6	4	0		
	8	2	2	A(6, 11)	
	12	4	3	C(9, 11, 12)	AHY-F(C,12)

^a U = nest site unknown.^b Birds fledged from three prematurely closed compartments not included nor are unfledged broods in B.

offspring in roosting position. The single instance of a female roosting with her young in their natal compartment (A, 17) represents a brood fledged on 29 July and probably not independent of parental care. A greater percent of older fledged native HY broods were represented by at least one member, but a greater percent of *individuals* from younger broods were present in the roost (Table 3). Either higher mortality or, more likely, partial dispersal and break up of kin groups explains the lower numbers but not the higher representation of older native HY broods in the roost. Also, there is an indication that larger broods were represented by relatively fewer individuals in the roost (Table 4), and

TABLE 3. Representation of 3 age classes of local HY martins in the roost on 3 August.

	Approximate age ^a			Total
	43 days	36 days	33 days ^b	
Number broods banded	14	11	2	27
Number young banded	56	37	6	99
Mean brood size	4.0	3.4	3.0	3.7
No. broods represented 3 August	12	8	2	22
% represented	86	73	100	81
Young present 3 August	31	24	6	61
% of all local HY present	55	65	100	62
% of young/brood present	66	89	100	76

^a Nestlings were banded on 7, 12, and 27 July. Age at banding was ca. 10–16 days, thus ages are estimated.

^b Probably not independent of parental care.

the correlation coefficient approaches significance ($r = .3296$, $.1 > P > .05$, $n = 25$).

Native HY broods with a known parent present were more likely to have all brood members in the roost, even though scattered among different compartments and houses. Furthermore, the presence of one or both parents was associated with a greater percent of brood also present regardless of when the brood fledged (Table 5). Ninety percent of the young were present if one or both parents were also present. Most parents present were females (7 of 9) whose mates had disappeared. At a martin roost (ca. 10,000 birds) near Langley Park, Maryland, Patterson estimated ASY males to constitute nearly 40% of the flock on 1 August, a figure suggesting that males do indeed leave independent broods before females do (Brown 1978).

Adults did not influence the use of compartments by HY martins, even though 5 compartments containing 1 to 3 adults had no HY martins ($P < .2$ by χ^2). However, in the two 24 compartment houses, there was a preference for all age classes to roost in the top 2 of the 4 tiers ($P < .001$, $\chi^2 = 26.5726$, 1 df).

TABLE 4. Original brood size and numbers of parentally independent local HY Purple Martins in the roost on 3 August.^a

Original brood size	No. broods	No. present on 3 August						Total	% present
		0	1	2	3	4	5		
2	4	1		3				6/8	75
3	3			1	2			8/9	67
4	14	3	2	3	2	4		30/56	54
5	4			1		1	1	11/20	55
Total	25	4	2	8	4	5	1	55/93	59

^a Excludes young banded 27 July, presumed to be dependent on parents.

TABLE 5. Number of young per brood at roost with a parent present.

House and nesting compartment	Adult sex present	Brood size	Young present	Days fledged
A— 2	F ^a	4	4	>14
6	F	5	5	>7 < 14
10	M & F	3	3	>7 < 14
17	F ^a	3	3	>7 < 14
22	F ^a	4	2	>14
B—21	M	4	4	>14
C— 1	F	4	4	>14
12	F ^a	4	3	>7 < 14

^a Mate also trapped in July, but absent 3 August.

DISCUSSION

What, at first impression, appeared to be a simple roosting aggregation of martins contained some biologically interesting patterns. It was composed of a surprisingly high number of foreign HY birds that roosted preferentially in the center house. Findlay (1971) and Brown (1978) found post-breeding defense of nest compartments by foreign sub-adult males. If our foreign HY birds were attempting to acquire future breeding compartments, they should have been randomly distributed as were the native HY birds. Since Screech Owls (*Otus asio*) (Allen and Nice 1952), raccoons (*Procyon lotor*), and black rat snakes (*Elaphe obsoleta*) (pers. obs.) are nocturnal predators upon martins, perhaps foreign HY birds were responding to a "selfish herd" effect resulting from predation pressure. Predation pressure from climbing predators might also explain the preference for top tiers by all birds.

Since only 6 of 251 (2%) young fledged from the colony since 1976 have returned to breed there, it is clear that foreign birds predominate in the breeding population. One suggestion is that HY birds search for future breeding sites after breeding adults have joined pre-migratory roosts and are no longer defending compartments. Brown and Bitterbaum (1980) used this assumption to produce an hypothesis to describe the function of juvenile harassment by breeding adult martins. They suggested that harassment insures that the juveniles would not become imprinted upon future nesting sites, thereby reducing future nest-site competition for the harassing adults. They suggested that late broods that are not subjected to harassment are more likely to return to natal colonies to compete with adults. This hypothesis is not supported by our data. In 1982, only 2 of the 137 HY birds in the 1981 roost returned to breed (less than 2%) even though no harassment by adults occurred in the 1981 roost. Furthermore, native HY birds in the roost were not primarily from late broods (Table 3) as their hypothesis predicts should be the case. Harassment did not keep young from returning to the

colony. The low return rate of HY birds to their natal colony seems not to be related to harassment by adults. Perhaps the low return rate results from low overall success by HY birds in attaining any breeding compartment their first breeding season, coupled with the very low proportion that native HY birds represent in the total pool of HY birds competing for nesting sites. The low return rate of HY birds from the 1981 roost suggests they were not searching for future nest sites but only for a safe place to roost.

However, adult harassment of fledged juveniles is a notable characteristic of martins that needs explanation. We suggest that it functions to reduce juvenile kleptoparasitism of food brought to unfledged broods. We commonly found fledged juveniles among non-sibling unfledged broods during our banding of 12 colonies in Maryland and Virginia. Morton has observed these kleptoparasitic juveniles to outcompete the smaller unfledged young for food. Apparently, parents are unable to distinguish the intruders from their own young inside the nesting compartments. The harassment may result from selection pressure on adults to reduce this food stealing and function to reduce the likelihood that fledged young can enter compartments while the adults are foraging away from the colony. The "reduction of kleptoparasitism" hypothesis explains why the adults doing the harassment are those with unfledged young and are often SY birds (first-time breeders). SY birds, because they breed later than older martins, have unfledged broods susceptible to kleptoparasitism by the fledged young of the earlier breeding ASY adults.

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LITERATURE CITED

- ALLEN, R. W., AND M. M. NICE. 1952. A study of the breeding biology of the Purple Martin (*Progne subis*). *Am. Midl. Nat.* 47:606-665.
- BROWN, C. R. 1978. Post-fledging behavior of Purple Martins. *Wilson Bull.* 90:376-385.
- , AND E. J. BITTERBAUM. 1980. Implications of juvenile harassment in Purple Martins. *Wilson Bull.* 92:452-457.
- FINDLAY, J. C. 1971. Post-breeding nest cavity defense in Purple Martins. *Condor* 73:381-382.
- U.S. FISH & WILDLIFE SERVICE AND CANADIAN WILDLIFE SERVICE. 1977. North American bird banding techniques, vol. II, Part 6. Dept. of the Interior, U.S. Fish and Wildlife Service.

National Zoological Park, Smithsonian Institution, Washington, D.C. 20008; and 12601 Buckingham Drive, Bowie, Maryland. Received 25 Feb. 1982; accepted 15 Oct. 1982.