

# COMPARATIVE MOBBING BEHAVIOR OF SCRUB AND MEXICAN JAYS

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MOBBING behavior has been used in studying interspecific recognition (Hartley 1951), changes in the intensity of an innate response from waning and habituation (Hinde 1954, 1960), and for analysis of changes in the emotional state of mobbing birds by use of calls (Andrew 1961). Here we consider the relationship between mobbing behavior and social organization in Scrub Jays (*Aphelocoma coerulescens*) and Mexican Jays (*A. ultramarina*).

Scrub and Mexican Jays of the southwestern United States are closely related species and both exhibit a well-developed mobbing response, but their social systems have pronounced differences (Brown 1963, 1974). Pairs of adult Scrub Jays maintain territories all year, whereas Mexican Jays are communal, occur in flocks year-round, and show group participation in nesting activities and care of fledglings (Brown 1970).

## METHODS

Tests used in this study fall into three categories.

(1) We studied mobbing behavior of free-living birds, using a live Great Horned Owl (*Bubo virginianus*) as the stimulus object. The owl was placed in an open space near the ground on a fallen log or stump. The site chosen afforded perches at a variety of heights and distances from the owl. During these sessions the observer sat in an inconspicuous position under a tree or bush at least 30 m away from the owl, recording the action with little effect on the mobbing birds. Observations and calls were recorded on tape using a Uher 4000-Report L tape recorder with a Uher M514 microphone.

(2) Wild-caught jays were placed in outdoor aviaries for holding. After adjusting to captivity, each was brought individually into the laboratory where it was placed in a 61-cm cubed wire mesh test cage with two perches running the width of the cage 15 cm from the front and 15 cm from the rear. A live Great Horned Owl was placed 6.1 m from the front of the test cage but was screened from view. The jay was left undisturbed for 2 h and was then watched for 6 min through a small window. If it seemed at ease, e.g. feeding, preening, or sleeping, the screen was removed, thus exposing the owl. Calls were recorded on tape and other activities were counted from outside the room. If after 2 h the bird was not at ease, it was allowed more time, up to 6 h. If the jay was still ill at ease, it was returned to the aviary.

(3) To learn something of the acquisition of the mobbing responses, four Scrub Jays and two Mexican Jays were taken from nests prior to fledging. Two additional juvenile Mexican Jays were captured shortly after they fledged and were aviary reared. These birds were also tested as described above.

## MOBBING BEHAVIOR IN THE FIELD

*A. ultramarina*. Mobbing behavior of Mexican Jays was watched in southwestern New Mexico and southeastern Arizona in May, June, and July 1970, and in March 1971. In all cases responses and the course of events were similar.

Mexican Jay flocks typically number 8–20 birds (Hardy 1961, Brown 1963). The mobbing flocks studied fell within this range and all participants during June and July 1970 appeared to be black-billed adults. Pale-billed birds mobbed with adults in March.

Often Mexican Jays were not first to discover the owl. Usually smaller passerines first discovered it and began mobbing, thus apparently attracting the jays. In all cases but one, mobbing by the jays lasted 35–45 min.

When a Mexican Jay discovered the owl the jay would land on an exposed perch, bob its body, simultaneously flit its tail, and give a series of loud “weeet” calls in rapid succession. This attracted the attention of others who then approached the owl and also began to mob. Initially flock members perched high in the trees. After about 3 min they moved closer and onto more exposed perches. Several of the jays then typically began diving at the owl, some coming to within an inch or so of its head, which usually caused the owl to flinch. The jays appeared always to approach from behind or from the side and often two or more jays approached the owl at the same time.

After 10–12 min some flock members left, but returned periodically. For the next 10 min three or four birds mobbed, but their approaches to the owl became less daring and less frequent. During the last 15 min of mobbing only one or two birds remained at a time. Their calls became less frequent and they tended to perch at greater distances from the owl. Eventually the jays left the vicinity.

*A. coerulescens*. Mobbing by Scrub Jays was studied in New Mexico and Texas in July and December 1970 and in March 1971. In December only one bird mobbed, although four Scrub Jays were in the vicinity. The other mobbing sessions were of about equal intensity and duration, lasting 15–20 min.

The owl generally was found by a single Scrub Jay, which then gave two basic calls, the “scree” and the “whew” (Brown 1963). Both undoubtedly are alarm calls and the “scree” appears to be the more intense.

Because of their territorial dispersion Scrub Jays formed mobbing groups more slowly than did Mexican Jays. No more than seven jays were ever seen around the owl. Usually the first Scrub Jay to mob was joined by other individuals within 2–3 min. These later arrivals mobbed

actively for only 5–10 min before leaving the vicinity and moving into nearby trees, or foraging on the ground.

Scrub Jays also mobbed less vigorously than did the Mexican Jays. Their movements were in general less pronounced and with few flights at the owl. As their responses waned, the birds either sneaked away or sat quietly in the bushes apparently watching the owl. Mobbing sessions were shorter than in the Mexican Jays, and once mobbing stopped, Scrub Jays were less inclined than the Mexican Jays to return and resume this activity.

#### MOBBING BEHAVIOR IN THE LABORATORY

Five wild-caught Mexican Jays and five Scrub Jays were tested individually in the laboratory during October and December 1970. All were exposed to the owl for at least 6 min.

As the jays mobbed, three activities were tabulated: calls, tail flits, and jumps from perch to perch (Fig. 1). The birds could move freely from side to side in the cage, jump from perch to perch, or perch to floor to perch (counted as one jump). When a jay jumped its posture was erect and it often jumped several times in succession. The flit is a rapid jerking movement of body and tail. The body is rapidly bobbed while the tail is jerked and fanned; body movements may be vertical or to the side.

Although tail flits appear to be flight intention movements (Daanje 1951), that term is somewhat misleading when applied in the context of mobbing. Mobbing birds in the wild flit their tails most rapidly when approaching the owl, but the flit does not necessarily precede the bird's flight, nor does it cause other birds to flee. It probably indicates fear, which is overridden by a stronger aggressive response to the owl. When the fear or withdrawal component prevails the bird moves away. In caged birds, jumps from perch to perch presumably indicate a tendency to flee from the owl.

Generally at the beginning of the session the jay spent almost all of its time on the front perch, with jumps to the rear followed immediately by jumps back to the front. After several minutes, the action became more evenly distributed between the two perches.

*A. ultramarina.* Every wild caught Mexican Jay continued to mob for the full 6 min. A regression analysis of calls per minute (dependent variable) against time in minutes (independent variable) yielded values of  $Y = 43.7 + 29X - 4.6X^2$  ( $N = 5$ ;  $F = 6.090$ ;  $P < 0.05$ ), which indicates an increasing rate of calling to minute 3 at which time the response begins to wane (Fig. 1B). A great deal of individual variation existed (Table 1).

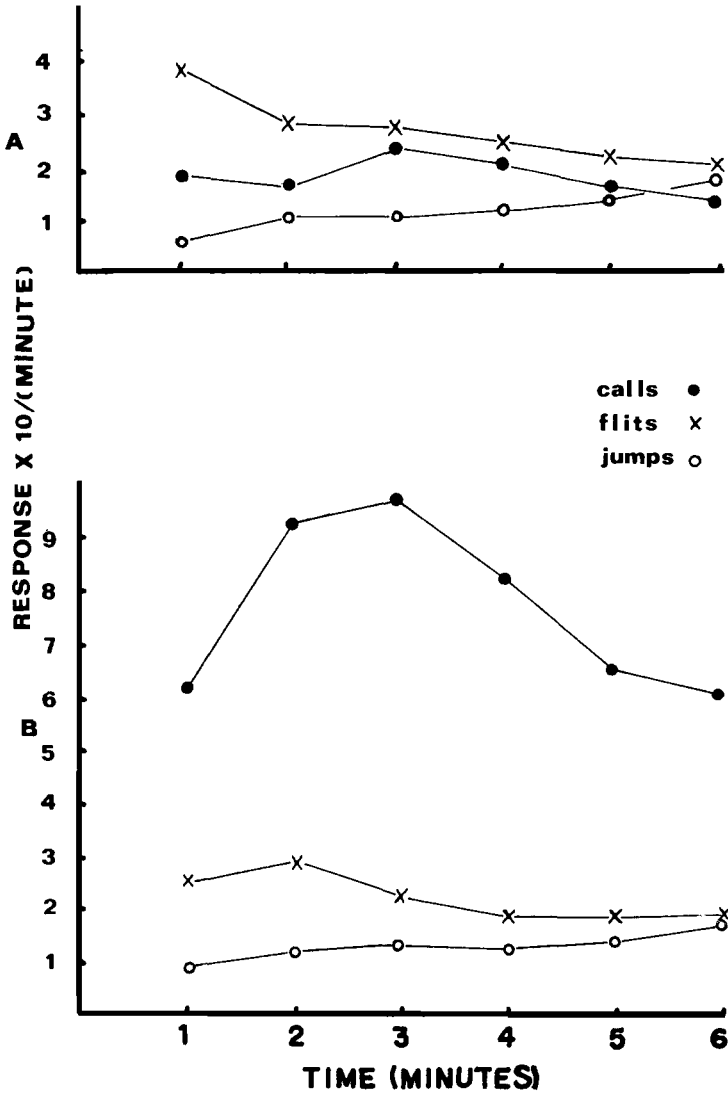


Fig. 1. A, mean mobbing response of five adult Scrub Jays to a live Great Horned Owl. B, mean mobbing response of five adult Mexican Jays to the Great Horned Owl. See text for elaboration.

Calls probably are a good indication of response level; after a general increase in call rate during minutes 1-3, the rate decreases in a waning curve not unlike that which Hinde (1954) reported for the Chaffinch (*Fringilla coelebs*). Jumps from perch to perch occur most frequently

TABLE 1  
RESPONSES OF MEXICAN JAYS TO A GREAT HORNED OWL

Jay	Date		Minute of exposure to owl					
			1	2	3	4	5	6
1	16 September	Calls	51	40	82	85	91	81
		Flits	— <sup>1</sup>	—	36	30	26	30
		Jumps	— <sup>1</sup>	—	2	0	0	0
2	17 September	Calls	129	163	144	141	137	127
		Flits	51	41	38	29	38	41
		Jumps	2	0	0	2	0	0
3	22 December	Calls	26	96	108	97	52	62
		Flits	17	34	18	12	8	7
		Jumps	0	14	20	20	23	27
4	23 December	Calls	50	78	87	49	37	23
		Flits	6	24	19	10	7	3
		Jumps	13	4	8	9	13	22
5	24 December	Calls	97	104	92	102	88	75
		Flits	20	10	5	6	7	13
		Jumps	23	36	33	28	22	30

<sup>1</sup> Not recorded in minutes 1 and 2.

during minutes with few flits, i.e. tail flits per minute and jumps per minute are inversely correlated (correlation coefficient =  $-0.719$ ;  $P < 0.01$ ;  $N = 28$ ). There was no significant regression of jumps or flits per minute with time, as there was for calls.

*A. coerulescens*. Responses of wild caught Scrub Jays to the owl were similar to those of Mexican Jays (Fig. 1A, Table 2). Scrub jays give fewer calls than Mexican Jays (analysis of variance test,  $F = 194.8$ ;  $P < 0.001$ ;  $N_1 = N_2 = 5$ ). In structure and probable meaning the calls are quite similar. Scrub Jays stood in a more nearly vertical posture and crouched more deeply than the Mexican Jays and often held their heads at a level below their feet. The slightly fanned tail was held in an almost vertical position. Tail flitting was less pronounced than in Mexican Jays, probably because of the Scrub Jays' more vertical posture.

The Scrub Jays generally started mobbing on the front perch, as did the Mexican Jays. The progress of mobbing varied more among Scrub Jays than among Mexican Jays, and we found no significant regression of calls against time, as occurred for Mexican Jays. A significant inverse correlation existed between jumps per minute and flits per minute (Correlation coefficient =  $0.611$ ;  $P < 0.01$ ;  $N = 30$ ); no significant regression of jumps or flits per minute occurred with time.

The most conspicuous difference between Scrub and Mexican Jays exposed to the owl in the laboratory was a tendency of Scrub Jays to

TABLE 2  
RESPONSE OF SCRUB JAYS TO A GREAT HORNED OWL

Jay	Date		Minute of exposure to owl					
			1	2	3	4	5	6
1	15 March	Calls	21	32	33	34	36	32
		Flits	41	34	40	42	40	32
		Jumps	1	2	0	0	0	0
2	15 March	Calls	10	4	8	6	5	6
		Flits	40	5	11	8	7	2
		Jumps	23	27	27	30	33	42
3	1 October	Calls	15	11	19	9	7	3
		Flits	51	46	35	35	39	34
		Jumps	4	3	2	4	3	10
4	6 October	Calls	22	28	26	22	19	19
		Flits	24	22	17	15	10	21
		Jumps	1	0	0	0	0	0
5	26 October	Calls	21	33	27	29	6	4
		Flits	22	33	31	20	9	5
		Jumps	2	4	3	4	3	3

become distracted during mobbing. After 3-4 min they often began to manipulate or eat food from the floor of the cage. Then they seemed again to notice the owl, called, and briefly resumed mobbing. As time progressed they paid less attention to the owl and spent more time in miscellaneous activities. Two Scrub Jays stopped mobbing at the end of 6 min.

#### MOBBING BEHAVIOR IN IMMATURE JAYS

To learn something of the development of mobbing behavior in these jays, four hand-reared Scrub and three Mexican Jays, and two aviary-reared Mexican Jays were tested in the laboratory as described above. The hand-reared Scrub and Mexican Jays were captured as nestlings and were housed in adjoining cages; thus experiences of these two groups were the same. (Captive adult Mexican Jays could be heard but not seen by all the birds.) The two aviary-reared Mexican Jays were captured shortly after fledging, at an age of about 27 days. They were cared for by wild-caught captive Mexican Jays.

An immature aviary-reared Mexican Jay (Mex-Y) that had previously seen adults mobbing an owl was tested first at 56 days of age, 24 days after it had been exposed to mobbing behavior. It did not mob; rather, it remained quiet in the "resting" or "neutral" posture until the owl was screened. Mex-Y was next tested at age 108 days and mobbed well for 6 min (Table 3). This bird's sibling (Mex-NB) was then shown

TABLE 3  
MOBBING RESPONSES OF IMMATURE MEXICAN JAYS

Jay	Age in days	Exposure No.	Minute of exposure to owl						
			1	2	3	4	5	6	
Mex-Y	56	2	No mobbing response						
	108	3	Calls	77	94	91	89	64	53
			Flits	37	31	21	23	18	10
			Jumps	5	6	9	7	13	12
Mex-NB	108	1	Calls	12	16	Terminated after 2 min.			
			Flits	7	6				
			Jumps	14	27				
	172	2	No mobbing response		See text				
	3	No mobbing response							
	4	No mobbing response							
Mex-O	179	5	No mobbing response						
	103	1	No mobbing response						
			183	2	Calls	50	62	53	47
			Flits	32	29	22	19	24	23
			Jumps	1	0	0	0	0	0
Mex-B	183	1	Calls	52	79	65	52	20	4
			Flits	36	23	18	19	7	9
			Jumps	1	2	0	0	2	0

the owl; it showed a fear reaction consisting of a few calls or flits and much jumping in the cage. After 3 min the owl was screened. Mex-NB was again shown the owl at age 172 and 179 days. Although this bird by now had seen an adult mob the owl, it showed no overt response when alone with the owl.

A hand-reared Mexican Jay (Mex-O) was shown the owl at an age of 103 days. It reacted by sitting quietly, as had Mex-Y on its first exposure to the owl. Mex-O was again shown the owl at age 183 days at which time it mobbed with moderate intensity. This bird's sibling, Mex-B, was then exposed to the owl for the first time and it too mobbed for 6 min.

The four Scrub Jays were tested at age 80 days. Three gave moderately strong mobbing responses (Table 4). The fourth bird did not mob, but sat quietly as had most of the Mexican Jays on their first exposure to the owl.

In a later study, using hand-reared jays, Ligon and Davis (MS) obtained a roughly similar pattern. Under controlled conditions similar to those described above, two of three Scrub Jays mobbed a mounted Great Horned Owl when first exposed to it at ages of about 134 and 140 days; none of seven Couch's Mexican Jays (*A. u. couchi*) mobbed at ages

TABLE 4  
MOBBING RESPONSES OF IMMATURE SCRUB JAYS

Jay	Age in days	Exposure No.		Minute of exposure to owl					
				1	2	3	4	5	6
Scrub-R	80	1	Calls	6	13	26	26	24	24
			Flits	46	17	25	36	25	27
			Jumps	11	8	17	21	31	26
Scrub-Y	80	1	Calls	0	0	0	1	0	1
			Flits	22	25	16	11	7	9
			Jumps	5	2	12	12	22	3
Scrub-O	80	1	Calls	7	10	20	21	24	25
			Flits	17	22	22	19	20	21
			Jumps	2	8	13	20	10	13
Scrub-W	80	1	No mobbing response						

of 134–160 days; and two of six Mexican Jays from southwestern New Mexico (*A. u. arizonae*) mobbed at ages 118 and 130 days. No other *A. u. arizonae* had mobbed by age 168 days.

Both studies suggest a similar conclusion: on the average Scrub Jays develop an apparently innate mobbing response at an earlier age than do Mexican Jays and this innate recognition of the owl occurs in a greater proportion of Scrub Jays.

#### DISCUSSION AND CONCLUSIONS

Before considering the evolutionary significance of interspecific differences in the mobbing response let us first review briefly the adaptive value of mobbing. The widespread nature of this behavior suggests that it performs some valuable function. In various species of birds manifestations of mobbing are much the same, with loud calls, rapid movements of the body or parts of the body, and the participation of more than one bird. The actions of mobbing birds are well attuned to expose a predator such as an owl. The calls are loud and easily located (Marler 1955). The frequent tail or wing flicking, combined with jumping, is immediately visible for some distance, and the more birds attracted, the more obvious becomes the predator's location. This pattern may continue either until the predator leaves or until the mobbing response wanes. The birds may then return shortly to mob with renewed intensity. Mobbing thus seems to make a predator move elsewhere, thus reducing the danger to the participating birds and their territory.

The difference in intensity of the mobbing response of Mexican and Scrub Jays may be related to two primary factors: (1) the pattern of



spatial distribution, and (2) the social compatibility of the members of the mobbing group. Birds may be regularly dispersed within their habitats, as in the territorial Scrub Jay. This possibly results in lower predation pressure as a result of the scarcity of individuals over a large expanse. Mexican Jays roost together, and thus are of more potential value to any nocturnal predator that found their roosting area. The chances of discovery of Mexican Jays by a nocturnal predator might be greater than for Scrub Jays, and it should therefore be of greater importance to a flock of Mexican Jays to make an owl roost far away from their territory. A Scrub Jay mobbing an owl on an adjacent territory would derive less benefit than the bird that it aids, and it could harm its own situation by making the owl roost closer to or within its own territory.

Further, Mexican Jay flocks are composed of closely related individuals (Brown 1974). Thus the comparatively reckless behavior of these jays may be a result of kin selection and serve to increase the fitness of the group (Hamilton 1964).

The other factor important in the intensity of mobbing is the social compatibility of flock members. Mobbing Scrub Jays generally maintained an individual distance of about 1 m. Mexican Jays exhibited no characteristics of individual distance during mobbing, and they did not seem to be distracted by other members of the flock. If one assumes that mobbing can be dangerous, then it becomes apparent that any distraction from the owl may increase the likelihood of injury. Because of its territorial nature an individual Scrub Jay may be distracted by the presence of conspecifics and thus be unable to give the owl its full attention. Therefore it mobs less impetuously.

Naive hand-reared Scrub and Mexican Jays appear to exhibit inborn differences in response to their first exposure to an owl. This probably is related to the social environment of each species. Immature Scrub Jays leave their parents' territories at 3 to 4 months of age (B. C. McKnight MS, see Westcott 1969). In such birds, which become independent of adult care at an early age, innate recognition of potential predators is probably of survival value.

In contrast, Mexican Jays remain with older, more experienced birds and thus can observe adult behavioral responses to a variety of environmental stimuli. This situation is conducive to a greater dependence on learning (Tinbergen 1965). Thus we suggest that the apparent differences in rate of development of an innate recognition of, and response to, the owl may be related to the early independence of immature Scrub Jays as compared to the prolonged maturation process and essentially continuous social contact of immature Mexican Jays (Brown 1963, 1974).

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