INTERSPECIES FLOCKING OF BIRDS OF MONTANE FOREST IN OAXACA, MEXICO

LESTER L. SHORT, JR.

FORAGING bird flocks containing several to many species are frequent during the non-breeding period in most of the world. I observed such flocks while participating in a Cornell University field expedition to Mexico, during August 1954. The observations were made from 26 to 29 August in pine–oak woodland at an elevation of about 9,300 feet in the vicinity of La Cumbre, 5 miles northeast of Cerro San Felipe, Oaxaca (see Sibley, 1950, pp. 152–154 for a description of this area). A number of foraging flocks were encountered, but only those watched for a period exceeding five minutes are mentioned below.

OBSERVATIONS

On 26 August two small foraging flocks were observed about one mile north of La Cumbre. Both flocks moved through the area of observation within seven minutes. The birds paid no attention to me as far as I could determine. Both flocks were composed of Gray-barred Wrens (*Campylorhynchus megalopterus*) and Spotted-crowned Woodhewers (*Lepidocolaptes affinis*), while a single male Hairy Woodpecker (*Dendrocopos villosus*) was also present in one flock. The wrens outnumbered the woodhewers by about three to one in both flocks (8:3 and 11:4). The constantly calling wrens generally foraged at middle elevations in the oaks, especially along the smaller branches. Occasional individuals flew to the ground to retrieve fallen food. The woodhewers foraged mainly on the trunks and major limbs of the trees.

One flock was observed near camp on 27 August. Only wrens were seen in this flock numbering about 20 birds, although individuals of other species may have been present, escaping detection in the dense foliage and undergrowth.

A large flock was observed in a small valley between La Cumbre and Cerro San Felipe on the morning of 28 August. The bulk of this flock was comprised of about 30 Gray-barred Wrens, a dozen Dwarf Jays (*Cyanocitta nana*), and eight Spotted-crowned Woodhewers. A pair of Mountain Trogons (*Trogon mexicanus*) (both collected later, see below) moved with the flock, perching quietly and not feeding. Two Steller's Jays (*Cyanocitta stelleri*) were also present in the flock. Wrens and jays called constantly, though not very loudly. The notes of the Dwarf Jay were similar to the "conversational" notes of the Blue Jay (*C. cristata*). At distances of 50 yards or more from the flock normal calls of all species were inaudible. In 15 minutes the flock moved 200 yards up the valley.

During the afternoon a small flock of Gray-barred Wrens (6–8) and Dwarf Jays (2) was noted about a mile north of the area in which the larger morning flock was observed. No trace of the latter flock was found late in the afternoon in the area in which it had been early in the day.

On 29 August three flocks were encountered one mile east–northeast of the valley in which the large flock of the previous day was seen. One of these was a small flock of about 20 birds, including Gray-barred Wrens (10–12), Dwarf Jays (4), and Spotted-crowned Woodhewers (4). The birds of this flock seemed more wary than others encountered, with vocalizations lower and more sporadic than in other flocks.

A second flock encountered about one-half mile north of the first contained a larger number of individuals and species. Species in this flock were Gray-barred Wrens (about 20), Dwarf Jays (5–6), Steller's Jays (2), Red-shafted Flickers (*Colaptes auratus*) (4), Spotted-crowned Woodhewers (4–5), one Hairy Woodpecker, and several Chestnut-capped Brush-finches (*Atlapetes brunnei-nucha*). The brush-finches were with the flock for the entire 20 minutes of observation, moving some 200 yards uphill in the pine–oak forest. Individuals were noisy (particularly wrens and jays), although most of the notes carried little. Diversity in foraging habits was exhibited with brush-finches on the ground, flickers mostly on the ground, the Hairy Woodpecker and woodhewers on the trunks and lower branches, and jays and wrens in the foliage. Dwarf Jays seemed more deliberate in their movements than the Steller's Jays, although the latter may have been more excited due to my presence. The wrens fed well up in the foliage, rarely descending into the undergrowth.

Over a hill to the west a larger flock was observed for several hours. It contained Gray-barred Wrens (35–40), Dwarf Jays (10–12), Spotted-crowned Woodhewers (10–12), Strong-billed Woodhewers (*Xiphocolaptes promeropirhynchus*) (2), one Mountain Trogon, several flickers, two Hairy Woodpeckers, Chestnut-capped Brush-finches (5), and Collared Towhees (*Pipilo ocai*) (3). Wrens and Dwarf Jays seemed to initiate forward movement of the flock. The flock moved along a hill to the north, across a ravine and then westward, covering about a mile while observed. The Strong-billed Woodhewers were wary, and disappeared about 20 minutes after I appeared. Collared Towhees were seen in only one area, and were with the flock for but a short time. Brush-finches were present constantly, but I could not determine whether or not the same individuals were involved. One interspecific encounter was noted, that being between a Gray-barred Wren which had flown to the ground after a food particle it had dropped and a brush-finch feeding close by. The latter was attracted to the fallen particle, but was driven off by

the wren. Encounters between or among wrens were frequent, but these were generally hidden by the foliage.

The following specimens were collected from foraging flocks near Cerro San Felipe:

Trogon mexicanus.—Male and female (Cornell Univ. Collection Nos. 26372 and 26371). Probably a pair as the two were closely associated. Taken 28 August from the largest flock observed. Gonads of both less than two millimeters.

Lepidocolaptes affinis.—Male and female (C.U. Nos. 26364 and 26363). Secured 28 August, one from an interspecies flock and one feeding alone. Both were adults, the male with testes under 2 millimeters and the female with a slightly enlarged ovary (5 mm.).

Cyanocitta nana (*"Cyanolyca" nana*; see Amadon, 1944; 6).—Adult female (C.U. No. 28363). Obtained on 27 August. Ovary slightly enlarged (5 mm.). The primary molt was in progress.

Campylorhynchus megalopterus.—Juvenile (sex ?, C.U. No. 26388). Collected on 26 August.

DISCUSSION

Aggregations of birds similar to those encountered in Oaxaca have been variously called parties, flocks, groups, bands, companies, assemblages, associations, and aggregations. It seems appropriate to use the term "flock" for such an association. A flock may be intraspecific or interspecific. There may be several types of flock activity, such as foraging or migrating, which can be used to further define the phenomenon. The Mexican flocks noted above may be designated interspecific foraging flocks.

Observations on flocks in Oaxaca tend to support certain points which have been noted by previous authors. Mitchell (1957) reported the rapid movement of foraging flocks in southeastern Brazil, noting that species with very different feeding methods keep pace with the general movement of the flock. Stanford (1947) has noted that Burmese birds which feed deliberately are able, nevertheless, to keep up with faster moving species in foraging flocks. Further observations on these movements are desirable. Miller (1922), Wing (1946), and Davis (1946) have stressed the importance of calls in keeping the flocks together. It seems evident that the constant calling of individuals in the Cerro San Felipe flocks served such a function, because the fog and general darkness of the pine–oak woodland on the slopes of the mountain often rendered the birds inconspicuous, if not undetectable.

The species found in the Mexican foraging flocks may be categorized as nucleus species, regular attendant species, irregular attendant species, and accidental species (modified from Rand, 1954, and Winterbottom, 1949). (See also Davis, 1946.) Although arbitrary to a considerable degree, these terms are useful. Nucleus species are those which are essential to flock formaiton and maintenance. Individuals of nucleus species are among the most numerous birds in the flock, if not the most numerous. These may occur in

intraspecific foraging flocks. Regular attendant species are those occurring regularly in interspecies foraging flocks, but which are not essential to flock formation and maintenance. They usually occur in fairly large numbers. Irregular attendant species are found less commonly and in smaller numbers, but are an active part of the flock when they do occur. Accidental species are those not actually moving with the flock for long periods, but which feed locally with the flock. Species encountered in interspecific foraging flocks in Oaxaca can be categorized as follows (general foraging areas indicated in parentheses):

I. Nucleus Species
   1. Gray-barred Wren (middle, upper and lower arboreal).
II. Regular Attendant Species
   1. Dwarf Jay (upper, middle arboreal).
   2. Spotted-crowned Woodhewer (middle lower arboreal).
III. Irregular Attendant Species
   1. Mountain Trogon (upper, middle arboreal).
   2. Steller's Jay (upper, middle arboreal).
   3. Red-shafted Flicker (terrestrial).
   4. Hairy Woodpecker (upper, middle, lower arboreal).
   5. Strong-billed Woodhewer (lower, middle arboreal).
IV. Accidental Species
   1. Collared Towhee (undergrowth).
   2. Chestnut-capped Brush-finch (undergrowth).

There is considerable disagreement concerning the relative importance (i.e., biological advantage) of flocking behavior exhibited by species participating in foraging flocks. The advantage of protection offered to individuals in such flocks has been pointed out by Miller (1922), Hindwood (1937), Allee (1938), Mitchell (1957), and others, but Winterbottom (1949) was skeptical about the protective value of flocking, and Rand (1954) considered it unimportant. There are two means by which individuals in a foraging flock may achieve greater protection than while foraging alone. One is due to the increase in the number of "receptor systems" (individuals) available for detecting potential predators. The other is by the "confusion effect" (Allee, 1938) or distraction of predators due to the presence of numbers of prey making it difficult for any predator to select and seize one individual from the flock. The value of the presence of more individuals to detect predators is self-evident. However, there is a possibility that this advantage may be overweighed by the increased attraction of predators to flocks due to the concentration of activity and vocalizations associated with them. The importance of the "confusion effect" is demonstrated by Miller's (1922) observation of the distraction of a predator (Sharp-shinned Hawk) upon encountering a foraging flock (of bush-tits). This observation suggests that selection may favor the avoidance of such flocks by predators.

Mutual aid in finding food is considered by some authors (e.g., Swynnerton, 1915; Gannon, 1934; Rand, 1954) to be a primary factor in the formation of foraging flocks. The discovery of a large food supply by one bird may attract others, enabling the sharing of food. This sharing probably involves a decrease in aggressiveness on the part of the discoverer of a food source as it feeds, the bird allowing closer approach by other individuals as its hunger diminishes. Another passive type of mutual aid is afforded members of foraging flocks by the movement of individuals occasionally causing insects in their paths to fly up, allowing their capture by other birds. This type of mutual "aid" would benefit species which chase after insects, but would not benefit species with other habits, as noted by Winterbottom (1943).

Probably of greater importance than protection or mutual aid is the efficiency gained by the foraging of birds in a given area in flocks, rather than individually. The rapid movement of the flock and the spacing of individuals within it (by birds maintaining individual distances, see discussion by Emlen, 1952) lessen the chance of one bird foraging in an area which has previously been worked over by another individual. The speed with which a flock moves may be adjusted rather precisely to provide an optimum period of feeding in each area with a minimum of wasted effort due to individuals moving into areas previously subjected to foraging. If this is so, small flocks with fewer individuals should progress more slowly than larger ones. Further observations are needed to determine whether or not this is true. At any rate, the spacing of individuals in foraging flocks, and the speed with which they move seem to insure a minimum of duplication of effort. Species which form intraspecific foraging flocks probably become the nucleus species of interspecific flocks because they have evolved habits and movements which by their nature lend themselves to use in regulation of the foraging activities of other species as well. Miller (1922: 126) aptly expresses the importance of feeding efficiency in foraging flocks as follows: "The flock represents the most economical method by which a given number of individuals can occupy a given foraging range." He points out the conservation of time and energy offered by this method, and also emphasizes the importance of individuals in such flocks crossing paths less frequently than they would if foraging individually.

Gregariousness has been stressed as the most important reason for flocking by Gannon (1934) and Sedgwick (1949). While there is little doubt that gregariousness or individuals' motivation to associate actually functions to form and maintain the flock, it is evident that such gregariousness is the means by which selection has brought about flock formation, answering the "how" of flocking rather than the "why." The "why" of foraging flocks may be answered by the biological advantages accruing to individuals participating

in such flocks. These advantages include an increase in feeding efficiency, an increase in protection from predators and mutual aid in locating food.

SUMMARY

Observations on several interspecific foraging flocks encountered during late summer in the highlands of Oaxaca, Mexico, are reported. Information is presented on species comprising the flocks and on flock movements. Some details of habits and calls of species involved are included. Categories of species observed in the flocks are nucleus species, regular attendant species, irregular attendant species, and accidental species. Advantages afforded individuals in foraging flocks are a greater feeding efficiency, protection from predators, and mutual aid in finding food. Flock formation and maintenance are due to the tendency of individuals to associate, i.e., the gregariousness characteristic of the species involved.

ACKNOWLEDGMENTS

Thanks are due to the other members of the field party, Fred C. Sibley and Ralph H. Long, Jr., for providing supplementary notes on their observations. Our investigations in Mexico were made possible by financial support provided us through grants to Dr. Charles G. Sibley by the New York State College of Agriculture and the Faculty Research Grants Fund of Cornell University. During preparation of this paper I have benefited from discussions of flocking with Millicent S. and Robert W. Ficken, who also kindly provided several pertinent references, for which I am grateful.

LITERATURE CITED

ALLEE, W. C.
1938 The Social Life of Animals. Norton & Co., New York.

AMADON, D.
1944 The genera of Corvidae and their relationships. *Amer. Mus. Novitates,* No. 1251.

DAVIS, D. E.
1946 A seasonal analysis of mixed flocks of birds in Brazil. *Ecology,* 27: 168–181.

EMLEN, J.
1952 Flocking behavior in birds. *Auk,* 69: 160–170.

GANNON, G. R.
1934 Associations of small insectivorous birds. *Emu,* 34: 122–129.

HINDWOOD, K. A.
1937 The flocking of birds with particular reference to the association of small insectivorous birds. *Emu,* 36: 254–261.

MILLER, R. C.
1922 The significance of the gregarious habit. *Ecology,* 3: 122–126.

MITCHELL, M. H.
1957 Observations on Birds of Southeastern Brazil. Univ. Toronto Press, Toronto.

RAND, A. L.
1954 Social feeding behavior of birds. *Fieldiana, Zool.,* 36: 1–71.

SEDGWICK, E.
1949 Mixed associations of small birds in the Southwest of Western Australia. *Emu,* 49: 9–13.

SIBLEY, C. G.
1950 Species formation in the Red-eyed Towhees of Mexico. *Univ. Calif. Publ. Zool.,* 50: 109–194.

STANFORD, J. K.
1947 Bird parties in forest in Burma. *Ibis*, 89: 507–509.
SWYNNERTON, C. F. M.
1915 Mixed bird parties. *Ibis*, 67: 346–354.
WING, L.
1946 Species association in winter groups. *Auk*, 63: 508–511.
WINTERBOTTOM, J. M.
1943 On woodland bird parties in Northern Rhodesia. *Ibis*, 85: 437–442.
1949 Mixed bird parties in the tropics, with special reference to Northern Rhodesia. *Auk*, 66: 258–263.

DEPARTMENT OF BIOLOGY, ADELPHI COLLEGE, GARDEN CITY, NEW YORK, 16 DECEMBER 1960 (ORIGINALLY SUBMITTED 12 SEPTEMBER 1960)

NEW LIFE MEMBER

Mrs. M. Stuart Roesler (Carol Stevenson), of Cos Cob, Connecticut, has been an active member of the Society since 1949, and is interested in warblers, bird behavior, life histories, and migration and the effects of weather upon it. She is a Life Member of the AOU, a member of the National Audubon Society, the Wilderness Society, the Sierra Club, and many others. Her hobbies include botany, wildflower photography, and painting landscapes with water colors. Between her two children, both married, one is an avid bird enthusiast.