

## OBSERVING MIXED-SPECIES FORAGING FLOCKS OF RESIDENT AND MIGRATORY BIRDS IN CARIBBEAN HABITATS

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Participants at the 1995 Society of Caribbean Ornithology meeting in Trinidad expressed interest in making observations on mixed-species flocks in Caribbean habitats. Our purposes in this brief note are to provide suggestions on how to quantify and standardize field observations of mixed-species flocks and to encourage SCO members to gather and publish their data on the composition, habitats, and behavior of mixed-species flocks.

Characteristic of tropical forest habitats, mixed-species flocks of birds typically consist of one or more nuclear individuals of a highly social and often vocal species, often a tanager, accompanied by individuals of other species. In certain mainland habitats, such flocks have highly stable composition, consisting of mated pairs of several species which travel together through a common home range throughout the year (Moynihan 1962, Valburg 1992). Such flocking behavior is poorly known in the Caribbean (Willis 1973, Ewert and Askins 1991, Carlo and Vilella 1992, Hamel and Kirkconnell 1995). It is possible that such flocks, which in the Caribbean consist of resident species as well as numerous migratory species during the northern winter, are an important part of the avifauna of the islands. Flocking may be an adaptive behavior of the nonbreeding ecology of migratory birds as well as resident Caribbean species. Because of the recognized importance of conservation of resident and endemic Caribbean species, as well as the interest in migratory birds expressed by the Partners-in-Flight ad hoc network (Pashley and Hamel 1995), studies of the composition and habitats of mixed-species flocks are important and timely contributions to Caribbean ornithology.

Our suggested techniques parallel those of Morse (1970), who reviewed literature on mixed-species flocks, and presented data and analyses of flocks in temperate North America. Morse (1970) identified several hypotheses to explain the function of flocking behavior. Whether flocks function to alert members to predators, to improve foraging efficiency of members (or both), or for some other advantage remain crucial questions for which no complete answers have been found. Observations of flock composition and behavior will help to answer these questions.

A flock is a group of birds that moves together in the same general direction, calling back and forth, or otherwise behaves in concert. Within a flock, the nuclear individuals or nuclear species will be recognized as those individuals that are generally in the center of the flock, that call more often or

more vigorously, and that are followed by the other individuals. Minimal observations of flocks consist of the identity and number of individuals of each species present in the flock. Observations of flocks may require several minutes for the identification of each species and numbers of individuals, especially for species that are relatively silent or slow moving. A suggested method for making observations involves a team of three persons. One observer counts the total number of birds in the flock. Tallying the number of individuals in the flock is most effectively done when the observer is at the front of the flock, although the observer must use care not to disturb the flock. The second observer identifies which species are in the flock and the total number of individuals (or proportion) of each. The third observer notes which species are the nuclear species, which species are followers, and which species join only as the flock passes through their territories. The team follows the flock until no longer able to do so, and then compiles their observations into a single summary of the observation of that flock (W. Barrow and C.-C. Chen, pers. comm.).

We suggest that flocks be tallied as to the date; time; location; and the number, age (e.g., juvenile, hatching year, after hatching year, etc.), and sex, whenever possible, of individuals of each species recorded. Particularly important are data on which species are the "nuclear species," or species around which the flocks form and which keep the flock together. In North America, these species are frequently parids (*Parus* sp.). In Cuba, the Yellow-headed Warbler (*Teretistris fernandinae*) and the Oriente Warbler (*T. forsi*), are the nuclear species (Quesada and de las Pozas 1984, Hamel and Kirkconnell 1995). In the Dominican Republic, the Black-crowned Palm-Tanager (*Phaenicophilus palmarum*) and the White-winged Warbler (*Xenoligea montana*) act as flock nuclear species (Vilella, pers. obs.). In Puerto Rico, the Puerto Rican Tanager (*Nesospingus speculiferus*) usually provides this function (Willis 1973, Carlo and Vilella 1992), the Lesser Antillean Pewee (*Contopus latirostris*) occasionally acts as a nuclear species (C. Delannoy, pers. comm.), and migratory species occasionally do so (W. Arendt, pers. comm.).

Additional useful data that should be gathered on flocks are numerous. For example, we suggest that observers record the habitat in which the flocks occur; the relative position in the vertical strata of the vegetation that the flock, as well as the individual members of the flock, occupy; the rate of movement

of the flock through the habitat, in m/min; the consistency of composition of a particular flock from day to day within a season (possible only when birds have been individually color banded); the participation of known individuals from season to season; the consistency of the home range or movement area of the flock from day to day and seasonally; the daily assembly of the flock; the roosting behavior of the flock members; changes in flock composition from breeding to nonbreeding season of resident species; intra- as well as inter-specific interactions (e.g., aggression) among flock members; changes in behavior of resident species as flock composition changes with arrival and departure of migratory species; a determination of which species participate only when a flock moves through its territory as opposed to members that participate throughout the "home range" of the flock; changes in behavior of species when participating in flocks as opposed to when solitary.

Other important observations include information on the phenology (flowers, fruits, seeds) of vascular plants (trees, shrubs, vines) in the areas visited by flocks. For example, in the Dominican Republic certain species of trees (e.g., *Trema micrantha*) commonly attract flocks of resident (e.g., *Xenoligea montana*) as well as migratory birds (e.g., *Dendroica tigrina*), that readily feed on their fruits (Dod 1978; S. Guerrero, pers. comm.). It is important to distinguish aggregations of birds attracted to localized resources like fruiting trees from flocks of birds that move jointly through their habitats.

Summaries of flock composition and size, by study area, will be useful for comparison of this phenomenon among islands of the Caribbean. Comparison of flock membership by species with species occurrence and abundance on point count data will provide information on the importance of mixed-species foraging flocks in Caribbean habitats. By noting individuals observed separately from flocks it will be possible also to determine the proportion of individuals of each species that participate in flocks, to determine any differences in flock participation among age and sex classes within species, to note the relative amount of time individuals of different species spend in flocks, and the propensity of different species to participate in flocks.

We look forward to corresponding with colleagues in the SCO concerning this phenomenon in the future. Our understanding of the importance of flock participation will assist in determination of conservation priorities among the islands of the Caribbean. Nuclear species are of potentially greater concern because their conservation may affect not only their own numbers but also, indirectly, those of other resident and migratory species which are regular flock atten-

dants.

To aid observers in recording data in the field, we include a field data sheet (Fig. 1). The scheme of Remsen and Robinson (1990) will be very useful for recording foraging behaviors. Remsen and Robinson (1990) identify 27 standard terms for foraging maneuvers (Fig. 1).

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