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Testing the roles of species in mixed-species bird flocks of a Sri Lankan rain forest

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Abstract: Studies of mixed-species bird flocks have found that 'nuclear' species, those important to flock coherence, are either intraspecifically gregarious or are 'sentinel' species highly sensitive to predators. Both types of species are present in flocks of a Sri Lankan rain forest: orange-billed babblers (*Turdoides rufescens* Blyth) are highly gregarious, whereas greater racket-tailed drongos (*Dicrurus paradiseus* Linnaeus) are less so, but more sensitive and reliable alarm-callers. We hypothesized that flock participants would be attracted to the playback of both species more than to the clearly non-nuclear yellow-fronted barbet (*Megalaima flavifrons* Cuvier). Further, we hypothesized that insectivores would prefer babbler vocalizations, as babblers could facilitate their foraging in several ways. We found that the response of insectivores was three times greater during babbler or drongo playback, and eight times greater during playback of these two species together, than during barbet playback or silence. Insectivores did not show, however, any difference in their response to babbler as compared to drongo playback; omnivores and frugivores responded relatively equally to all treatments. Our results show that birds with high propensity to flock, such as insectivores, use the vocalizations of nuclear species to locate flocks and that a sentinel species may be as attractive as a highly gregarious species.

Key Words: avian community ecology, *Dicrurus paradiseus*, heterospecific attraction, mixed-species flocks, nuclear species, playback, sentinel species, Sri Lanka, *Turdoides rufescens*

INTRODUCTION

Mixed-species flocks are a striking feature of tropical avifaunas (Powell 1985, Thiollay 1999). The rising number of descriptions of flocks throughout the world allows ecologists to look for general patterns in flock composition and organization and to deduce the forces that structure these non-trophic communities. In the study of flock organization, researchers have repeatedly found that some 'nuclear' species seem important to the formation or maintenance of the flocks, whereas other 'adherent' species add little except their presence (Dolby & Grubb 1998, Moynihan 1962, Winterbottom 1943). Species are considered nuclear if they are found in a high percentage of flocks, are rarely found outside of flocks, and lead flocks, being joined by other species more than they follow other birds (Hutto 1994, Moynihan 1962).

Two types of nuclear species have been observed. The first type includes intraspecifically gregarious species, such as tits (family Paridae) in temperate regions (Morse 1970), or babblers (family Timaliidae) in Asia (Kotagama & Goodale 2004). The second type includes those species not particularly gregarious but highly sensitive to the presence of predators, and hence called 'sentinel' species (Greig-Smith 1981, Munn 1984). This sensitivity to predators may be related to foraging technique: in the tropics, sentinel species usually capture insects in the air (by 'sallying'), and their visual scanning for prey may allow them to see predators more quickly than species that search for food off of the substrate (by 'gleaning'; Goodale & Kotagama 2005, Munn 1984). These two types of nuclear species are both found in a flock system of a Sri Lankan rain forest: orange-billed babblers (*Turdoides rufescens* Blyth) are highly gregarious leaf-gleaners, whereas the sallying greater racket-tailed drongos (*Dicrurus paradiseus* Linnaeus, family Dicruridae) are less gregarious but more sensitive and reliable alarm-callers (Table 1). Babblers and drongos tend to be closely associated in the front of flocks, making it difficult to

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