Regional variation in the composition and structure of mixed-species bird flocks in the Western Ghats and Sri Lanka

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Mixed-species bird flocks are attractive models for the investigation of geographical variation in animal communities, as they represent a subset of the avifauna in most forested regions of the world. Yet studies of the regional variation in flock size and the composition of flocks are few, due to the predominance of studies carried out at single study site. Here, we review nine studies of mixed-species flocks conducted at 16 sites along the Western Ghats in India and in Sri Lanka. We find that flock size varies as much within this region as it does globally, with observation time being a confounding variable. Flock composition, however, is predictably related to elevation. Flocks at high elevations (>1200 m) in the Western Ghats strongly resemble flocks at high elevations in the mountain ranges of Sri Lanka in their composition, especially at the family level. We compare these flocks to flocks of other regions and make recommendations on study methodology that can facilitate comparisons across studies.

Keywords: Bird communities, biogeography, mixed-species flocks, Western Ghats.

MIXED-species flocks are a characteristic feature of bird communities throughout the world, especially in birds of forested regions and in the tropics[1,2]. Flocks are defined as an association of two or more species that move consistently without respect to the location of specific food resources in contrast to aggregations[2]. Most studies of mixed-species flocks have focussed on the adaptive benefits to flocking[3–5]. Less is known about the degree of co-evolution among members in flocks[6], and whether flocks represent a structured community with some species always or never found together[7–9].

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Studies of the biogeography of flocks have the potential to address questions of community organization, but are rare, especially at the regional scale. Most studies gather data at one site; for example, Buskirk[10] and Thiollay and Jullien[11] compared the ecology of birds at one site to investigate why some species are found in flocks and some are not. On the opposite extreme of the scale, Thiollay[1] has compared mixed-species flocks systems in multiple sites on several continents; in such a case, different study sites contain different species, and often different families of birds. In contrast, at an intermediate geographical scale, regional studies can ask whether some species play similar roles in flocks in different areas, or whether associations between species or families can be found repeatedly in flocks. Regional studies can be conducted by one researcher[12–14] or can be reviews of multiple studies[2,15]; as yet they have been largely restricted to the Neotropics (but see Diamond[16] for work in Papua New Guinea).

The flocks of South Asia present an interesting opportunity to study questions of flock variation on the regional scale. Although mixed-species flocking is widespread in the area[17], few systematic studies of flocks were conducted until the 1990s (but see Partridge and Ashcroft[18], MacDonald and Henderson[19], and Vijayan[20]). Over the last decade and a half, however, there has been a growing interest in the subject, and a flurry of activity particularly along the Western Ghats and Sri Lankan mountain ranges[21–27]. We review this literature and synthesize and reanalyse this data to investigate geographical variation within this region. Specifically, we ask whether (a) similar flock systems can be found in areas with similar environments, (b) whether there are distinct flock systems in different environments, and (c) what occurs in intermediate environments – do systems blend together, or co-exist? For environmental gradients, we focus on elevation, and