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The effect of the surrounding landscape matrix on mangrove bird community assembly in north Australia

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ABSTRACT

Mangroves are highly threatened ecosystems yet their community ecology is poorly understood. We examined the ecological determinants of bird community assemblage in floristically depauperate mangroves. Birds were surveyed using line transect methods. Large mangrove patches supported fewer species than smaller patches. Patches did not comprise nested species subsets and the bird species richness of several small patches combined was greater than a single large area. The number of mangrove dependent species in a patch was area-dependent suggesting these species may be resource limited, although there was no species density compensation. There was a clear effect of the surrounding habitat, with matrix species accounting for ∼45% of bird species in a patch. Patches surrounded by tropical savanna were relatively species-poor, while regardless of size, patches including monsoon rainforest were relatively species rich. Null model analysis of non-random assemblage structure (nestedness and species co-occurrence) revealed no deterministic structure to the overall mangrove species assemblage. These analyses described a random pattern of bird distribution and with no evidence of density compensation this suggests that competition is a weak structuring force of mangrove bird assemblages. The lack of nestedness and the random co-occurrence of species are consistent with the matrix-dependence of bird community composition. Conservation plans should treat mangrove patches as part of a habitat mosaic and incorporate many smaller mangrove patches rather than just big ones. Consideration of the nature, extent and diversity of the surrounding matrices is vital in managing and conserving mangrove bird communities.

1. Introduction

Mangrove ecosystems are among the most threatened habitats globally (Luther and Greenberg, 2009). They comprise only 1% of the natural habitat in the Northern Territory, Australia, yet they contain more mangrove bird endemics than any other mangroves worldwide (Noske, 1996). The floristically richer mangroves in northern Queensland have fewer mangrove bird species (Kutt, 2007; Noske, 1996), with few mangrove dependent species (MDS) compared to north-western Australia (Ford, 1982), making mangroves in the Northern Territory unique and important to mangrove bird conservation. The mangrove tree community is simple with little functional diversity, often lacking understory growth and is much less species rich than other tropical forest ecosystems (Alongi, 2002). Commensurate with the simplicity of vegetation structure and composition, and constrained by relatively few niches and resources, the mangrove bird community is expected to be simple in structure and composition and community assembly is predicted to be controlled by a few dominant mechanisms.

Several mechanisms are proposed to explain the maintenance of species diversity within ecological communities (Chave et al., 2002; Morin, 1999). These are broadly grouped into equilibrial and non-equilibrial mechanisms, both of which shape community-level properties such as species–area curves, relative-abundance distributions, and spatial patterns of species occupancy. Equilibrial mechanisms tend to maintain constant species composition over time. They are based on functional differences among species invoking differing competitive abilities as the primary driver (i.e., competition-structured) of niche differentiation and community composition (Putman, 1994). Systems close to or at equilibrium are assumed to be ecologically saturated, resource limited, and governed by biotic interactions, especially competition (Wiens, 1984). In contrast, non-equilibrial hypotheses explain community composition as a balance between immigration and extinction and species composition changes constantly over time (MacArthur and Wilson, 1967). Non-equilibrial systems are not ecologically saturated, instead they have empty niches, periods of resource abundance and are mainly event driven (Cornell, 1993).

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