

## **MA43 Niche separation and the impacts of disturbance on bird communities in dry forest**

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The dry forests ecosystems of Mahamavo support approximately 45 bird species, including a total of 37 species endemic to Madagascar and the nearby Indian Ocean Islands. This gives a local endemism rate of 82% - by far the highest of any bird community across Operation Wallacea's tropical field sites. Bird assemblages here include representatives of most of the characteristic Malagasy groups that can be found nowhere else on Earth, including Vangas, Couas, and Fodys. Other notable species include large raptors, parrots, and tiny, jewel-like Sunbirds.

Research into the relationships between bird community composition (with a particular emphasis on niche partitioning), habitat structure, and disturbance levels has formed the core theme of bird dissertation projects in Mahamavo for several years, and this remains a very solid option for dissertation students wishing to undertake research here. The crucial importance of this research theme stems from the fact that, like many tropical island endemics around the world, the endemic birds of Madagascar face great potential threats from anthropogenic activity and associated habitat modification, but very little is known about how well these specialized endemics can adapt and utilize the disturbed habitats which are becoming increasingly common across the tropics. This lack of understanding makes it difficult to form strategies to conserve these species effectively, and so dissertation projects in this study theme have the potential to contribute to future conservation policy here. The impact avifaunal research can have on informing conservation policy is enhanced by the fact birds are often considered a key indicator taxa. They are comparatively easy to sample and, as changes in bird communities often reflect changes in other, more cryptic biological groups, patterns identified in the study of tropical birds can often be applied (to a certain extent) to patterns in the ecosystem as a whole.

Students taking this option will use two key methodologies to survey bird communities in the Mahamavo forests – point counts and mist nets. Point counts involve surveying a number of fixed pre-set points scattered throughout Mahamavo. Students will visit each study plot several times and survey all birds seen and heard over a 10-minute period within a set radius. These point-counts will be completed early in the morning, between 06:00 – 08:00, as this is the period where bird activity and vocalization is highest, thus yielding the greatest number of contacts. Most contacts will be identified by call rather than by sight. In this respect students are at a considerable advantage here compared to other tropical study sites due to the relatively low number of species occurring in Mahamavo. This allows students to be trained in the vast majority of bird calls quickly, meaning few species are misidentified and facilitating the creation of high quality point count datasets. Mist-netting involves the capture of birds in fine-mesh nets from which they are removed by trained bird banders, identified, ringed, and then released. Mist net surveys will be completed at the same locations at the point counts and will allow for the detection of cryptic understory species frequently missed by the point counts. In combination these two methods will allow students to generate highly representative samples of avifaunal community structure across different habitat types in the Mahamavo forests.

Extensive habitat surveys will also be completed by students at each of these study points, with key variables such as mean tree size, canopy and undergrowth density being measured. Geographical variables such as slope angle, elevation, and geology will also be recorded. Students will also be able to compare bird community data with extensive pre-existing spatial GIS datasets encompassing variables such as landscape-scale topography, regional precipitation patterns and broad land-use types.

This combination of bird demographic, habitat, and landscape-scale GIS datasets will allow students to examine a number of research questions within this research theme; the extent to which bird communities – either as a whole or within different sub-groups such as endemic species, feeding guilds or specific families or indicator species - respond to disturbance; what are the key ecological and biogeographical variables predicting avian richness or community composition on both local and landscape scales, and what is the conservation value of different forest types for supporting the region's unique avifauna.

These patterns can be explored in several ways. On a local scale, differences in avifaunal richness as a whole or richness of particular subgroups between sites can be compared using simple statistical tests (T-tests, One-way ANOVA etc) and the key variables governing distributions can be analyzed by looking at correlations between habitat data and bird abundance or richness. Larger scale analysis could involve generating species distribution maps and habitat suitability models, with students calculating the percentage of distribution variability that can be explained by different environmental covariates (eg. elevation, climate, land cover). Students may wish to place a particular emphasis on niche separation patterns identified by these maps – ie examine the distribution of two closely related species and determine the level of niche separation by calculating the degree of distribution overlap; an avenue of research which has produced very interesting results in previous studies within the Mahamavo forests.

In summary, students taking this dissertation option will be able to generate powerful datasets and investigate a number of important research questions relating to habitat associations of the bird species from different ecological niches in the Mahamavo forests, along with implications of their differential conservation priorities. This research will be highly valuable in informing conservation policy towards the highly endemic, increasingly threatened, but poorly-understood Island avifauna of Madagascar.

### **Suggested Reading**

Andrianarimisa, A., Bachmann, L., Ganzhorn, J.U, Goodman, S.M. & Tomiuk, J. (2001). Effects of forest fragmentation on genetic variation in endemic understory forest birds in central Madagascar. *Journal für Ornithologie* **141**: 152-159.

Bibby, C.J., Burgess, N.D., Hill, D.A. & Mustoe, S.H. (2002). *Bird Census Techniques (Second edition)*. Academic Press, London.

Dent, D.H. and Wright, .S.J. (2009). The future of tropical species in secondary forests: a quantitative review. *Biological Conservation* **142**: 2833-2843.

Eguchi, K., Yamagishi, S. & Randrianasol, V. (2008). The composition and foraging behaviour of mixed-species flocks of forest-living birds in Madagascar. *Ibis* **135**, 91-96.

Goodman, S.M. & Benstead, J.P. (2005). Updated estimates of biotic diversity and endemism for Madagascar. *Oryx* **39**: 73-77.

Long, P. (2013). Biodiversity surveys of Mariarano and Matsedroy tropical dry forests and associated wetlands, Western Madagascar. Operation Wallacea report. Accessible from [http://opwall.com/wp-content/uploads/Mahamavo-2013\\_report\\_Final-Compil-Sam-2.pdf](http://opwall.com/wp-content/uploads/Mahamavo-2013_report_Final-Compil-Sam-2.pdf)

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B. & Kent, J. (2000). Biodiversity hotspots for conservation priorities. *Nature* **403**: 853-858.

Raxworthy, C.J., Ingram, C.M., Rabibisoa, N. & Pearson, R.G. (2007). Applications of Ecological Niche Modeling for Species Delimitation: A Review and Empirical Evaluation Using Day Geckos (*Phelsuma*) from Madagascar. *Systematic Biology* **56**, 907-923.

Sinclair, I. (2004). *Birds of the Indian Ocean Islands: Madagascar, Mauritius, Réunion, Rodrigues, Seychelles and the Comoros*. Struik Publishers, London.

Trevino, H.S., Skibiel, A.L., Karels, T.J. and Dobson, K.F. (2007). Threats to avifauna on oceanic islands. *Conservation Biology* **21**: 125 – 132.

Watson, J.E.M., Whittaker, R.J. & Dawson, T.P. (2004). Habitat structure and proximity to forest edge affect the abundance and distribution of forest-dependent birds in tropical coastal forests of southeastern Madagascar. *Biological Conservation* **120**: 311-327.