

The Research Group

Ecology and Biodiversity

has the honor to invite you to the public defense of the PhD thesis of

Hajaniaina Andrianavalonarivo RATSIMBAZAFY

to obtain the degree of Doctor of Sciences

Title of the PhD thesis:

*A spatial arrangement and governance system for the future
Malagasy network of Marine Protected Areas*

Promotor:

Prof. dr. Marc Kochzius

The defence will take place on

Tuesday May 21 2019 at 16:00h

in Auditorium D.0.07 at the Campus Humanities,
Sciences and Engineering of the Vrije Universiteit
Brussel, Pleinlaan 2 - 1050 Elsene, and will be
followed by a reception.

Members of the jury:

Prof. dr. Franky Bossuyt (chairman)
Prof. dr. Kim Roelants (secretary)
Prof. dr. Jean Hugé (co-promotor)
Prof. Thierry Lavitra (co-promotor)
Prof. dr. Farid Dahdouh-Guebas
Prof. dr. Dominique Maes
Prof. dr. Thierry Backeljau (RBINS)
Prof. dr. Sofie Derycke (ILVO)

Curriculum vitae

H. A. Ratsimbazafy graduated as Master of Fisheries Science in 2010 and Master of Marine and Lacustrine Science and Management in 2012. He started his PhD on the Malagasy MPAs in 2014. The research was funded by the VLIR ICP PhD programme. His research resulted in 6 publications in peer-reviewed journals of which 3 as first author, 3 more articles are in preparation. In addition, Haj supervised two MSc and two BSc students and assisted in several practical courses, excursion, and internship. He also delivered oral presentations in six international conferences.

Abstract of the PhD research

According to the Malagasy National Institute of Statistics (INSTAT), a high portion of the Malagasy population (68.7 % in 2005, 76.5 % in 2010) lives below the international poverty line of US\$ 1.25 per day. On the one hand, 80 % of that population depend entirely on natural resources, while on the other hand, Madagascar is well known as a biodiversity hotspot with a very high percentage of endemism, thus it is a high conservation priority area. This high importance of natural resources and high human pressure has led to the engagement during the IUCN World Parks Congress of 2003 in Durban to triple the total area of protected areas in Madagascar (10 % of the total area of the country) by 2012. Seventy-nine per cent of that goal was achieved, however only 0.1 % was assigned for Marine Protected Areas (MPAs). The terrestrial mega-diversity of Madagascar outshined its marine counterpart, which is substantial for livelihood. Therefore, Madagascar took again an engagement during the latest World Parks Congress in Sydney (November 2014) to triple this time the extent of its MPAs by 2020. Thus, information is urgently needed to support decision-makers in site selection and management of an efficient MPA network around the island.

It is proposed that the spatial distribution of MPAs should match the dispersal capabilities of each targeted organism. The present study attempts to use five key species to investigate the level of genetic diversity, the genetic population structure and connectivity for 18 potential conservation sites along the Malagasy coast using mitochondrial COI sequences and nuclear microsatellite markers. These key species are from coral reefs, such as the blue sea star *Linckia laevigata* and *Octopus cyanea*, as well as from mangroves, such as the snail *Terebralia palustris* and prawns such as *Penaeus semisulcatus* and *Penaeus monodon*. The results can be used as a proxy for other species that have similar biological features. This study highlights the fact that the genetic populations in the Western Indian Ocean (WIO) are significantly different from other regions of the Indo-West Pacific. Within the WIO, Madagascar is also different from the east coast of Africa. Moreover, several genetically distinct populations occur around Madagascar, except in *O. cyanea*. Interestingly, the actual spatial distribution of MPAs is not covering all existing populations around the island. It is therefore recommended to consider those uncovered populations to avoid overfishing.

Regarding the governance in the sector of marine conservation, mainly to initiate reflections on the future management of MPAs in Madagascar, we performed an iterative expert survey using the Delphi approach. We analysed the historical outline of MPA establishment and develop exploratory scenarios regarding the further assignment and management of MPAs in Madagascar. Results highlight that (1) international initiatives and funding have played a key role in the early days of the MPA emergence in Madagascar, (2) co-management between governmental and non-governmental actors showed mixed results regarding conservation effectiveness, (3) challenges include a better coordination of efforts among various stakeholders, granting a large responsibility to local communities, and integrating customary law into the set of regulations for marine conservation and sustainable management in Madagascar, and (4) success of a MPA could be measured ideally by the existence of alternative livelihoods, the level of law enforcement and the level of participation in decision making. This process also allowed to provide recommendations for the current management.