Habitat recovery assessment of reforested mangrove sites in the Gazi Bay, Kenya: a study testing the role of molluscs as bioindicator species

F. Dahdouh-Guebas[1,2], B. Satyanarayana[1,2], B. Pecceu[2], D. Di Nitto[1,2], K. Van Den Bossche[2], G. Neukermans[2], J.O. Bosire[3], S. Cannicci[4] & N. Koedam[2]

[1]Laboratory of Systems Ecology and Resource Management, Dept. of Organism Biology, Faculty of Sciences, Université Libre de Bruxelles - ULB, B-1050 Brussels, Belgium. E-mail: fdahdouh@ulb.ac.be
[2]Laboratory of Plant Biology and Nature Management, Mangrove Management Group, Vrije Universiteit Brussel - VUB, Pleinlaan 2, B-1050 Brussels, Belgium.
[3]Kenya Marine and Fisheries Research Institute (KMFRI), P.O. Box 81651, 80100 Mombasa, Kenya.
[4]Department of Evolutionary Biology, University of Florence, via Romana 17, Florence, Italy.

Abstract

The present study attempts to assess the habitat recovery of 9-12 years old reforested mangrove sites, in terms of successful growth and colonization of flora/fauna, in comparison to natural vegetation in the Gazi Bay, Kenya. Six sites encompassing 2 reforested and 4 natural mangrove vegetation represented by *Ceriops tagal* were investigated. In each site, data on young/adult vegetation, sediment characteristics and the abundance of 3 molluscs - *Terebralia palustris*, *Cerithidea decollata* and *Littoraria* spp., were collected. Adult tree density in the natural sites varied between 5768 and 9294 stems ha^{-1} (basal area: 10.5-16.9 m^2 ha^{-1}), whereas in the reforested sites it was 1120-10800 stems ha^{-1} (basal area: 0.9-11.4 m^2 ha^{-1}). In both areas, the young vegetation with a height ranging from 40 to 130 cm was abundant (3429-59467 stems ha^{-1}). Except for nutrients (ammonia, total nitrogen and phosphate), the soil characteristics such as salinity, organic matter, sediment moisture and fine sediment did not show large variations between the two areas. The PCA based analysis indicated marked differences, although not significant, between the natural sites 1 and 4 (One-Way ANOVA, F = 0.1, P = 0.8), and between the reforested sites 1 and 2 (One-Way ANOVA, F = 1.1, P = 0.3). Although mollucan density represented by *C. decollata* and *Littoraria* spp. was high in the reforested site 2 (74 ind m^2), mollucan biomass was maximum in the natural mangrove site 2 (32 g m^2) due to the presence of *T. palustris*. The correlation coefficients drawn between molluscs and soil-vegetation parameters (through the BEST analysis implemented in PRIMER v.6) are optimized only for sediment moisture and tree height (ρ = 0.94), confirming that food and shelter play a significant role (P < 0.05) for their distribution. In addition to soil and vegetation factors being considered to influence the distribution of moullucs, the tree morphology and faunal competition were also found important in the present study. In view of the luxuriant growth by *C. tagal* in reforested site 1, it could be considered as a successful plantation. In contrast, the reforested site 2 was an indicative of environmental stress (for mangrove regeneration as well as their endurance) in the back mangrove environment. Overall, the three mollucan populations tested for habitat recovery assessment in the Gazi Bay have necessitated other field-based observations (e.g. site location, tree foliage, etc) in support.