

## Evidence of chronic anthropogenic nutrients within coastal lagoon reefs, adjacent to urban and tourism centers, Kenya: A stable isotope approach

Jelvas Maina Mwaura<sup>2</sup>, \*Yu Umezawa<sup>1</sup>, Takashi Nakamura<sup>3</sup>, Joseph Kamau<sup>2</sup>

1. Nagasaki University, 2. Kenya Kenya Marine & Fisheries Research Institute, 3. Tokyo Institute of Technology

The sources of anthropogenic nutrients and its spatial extent in three fringing reefs with differing human population gradients in Kenya were investigated using stable isotopes approaches. Nutrient concentrations and nitrate  $\delta^{15}\text{N}$  in seepage water clearly indicated that population density in the catchment and tourism along the coast contributed greatly to the extent of nutrient loading through the groundwater to adjacent reefs in Kenya. Although water column nutrient analyses did not show any significant difference among the 3 studied reefs, the chemical contents (i.e.,  $\delta^{15}\text{N}$  and N contents) in the macroalgae and complementary use of seagrasses and sedimentary organic matter clearly indicated the different nutrient regime among the sites in higher special resolution. Higher  $\delta^{15}\text{N}$  and N contents in macrophytes showed terrestrial nutrients affected primary producers at onshore areas in Nyali and Mombasa reefs, but were mitigated by offshore water intrusion especially at Nyali. On the offshore reef flat, where the same species of macroalgae were not available, complementary use of  $\delta^{15}\text{N}$  in sedimentary organic matter suggested input of nutrients originated from the urban city of Mombasa. If population increases in future, nutrient conditions in shallower pristine reef, Vipingo, may be dramatically degraded due to its stagnant reef structure. This study represent the first assessment of the Kenyan coast that integrates water column nutrients and macrophyte  $\delta^{15}\text{N}$  analyses, showing direct evidence of the use of terrestrial nutrients by macrophyte and providing basic information for surveying the link between anthropogenic enrichment and ecosystem degradation including macroalgae proliferation in nearshore reefs.

Keywords: anthropogenic nutrient, stable nitrogen isotope, Kenyan coral reefs, macroalgae