Assessment of the environmental status using planktonic components in tropical marine systems: case of Mayotte and Glorieuses islands.

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Suitability of quality indices based on plankton communities to tropical marine systems was assessed by comparing twenty-three relevant indices including water chemistry and biological components (bacteria, phyto- and zooplankton), during field studies performed around Glorieuses Islands (November 2015 and May 2016), and Mayotte lagoon (May 2016).

According to 2006 Water Framework Directive reference thresholds, we determined indices based on "good status" in terms of chlorophyll biomass index, “good status” in terms of picoplankton (size <2 μm) abundance index and "very good state” in terms of nanoplanckton (2 to 20 μm) abundance. No significant difference between the two ecosystems was detected in terms of chemical descriptors. By contrast, significant differences were observed according to biological characteristics: no loricates ciliates were found at Glorieuses whereas abundant in Mayotte, high density of picoeukaryotes and Synechococcus with an elevated SYN / PROC ratio (Synechococcus versus Prochlorococcus cell densities) in Mayotte compared to Glorieuses, linked to larger terrestrial nutrient inputs.

Eleven different microalgal pigments were identified and quantified by HPLC, among which "Zeaxanthin" related to picocyanobacteria (SYN and PROC) and green algae was important both in Glorieuses and Mayotte. "Fucoxanthin" (related to bacillariophyceae) was consistant in both ecosystems, but predominant at two stations of Mayotte. "Peridinin" (related to Dinoflagellates) was found at each station in Mayotte, but only at one station in Glorieuses (GLO 2).

In terms of bacterial contamination pressure, no evidence of faecal contamination (coliforms and streptococci) was noted at Glorieuses whereas two stations in Mayotte (M'Bonzi and Tanakari) exhibited high contamination level and poor water quality compared to WFD (EU Water Framework Directive) thresholds. We have adapted several other indices documenting trophic status of the ecosystem, such as the IPI “integrated phytoplankton index” developed by Spatharis & Tritis (2010), the PHY-HAB “5 indices between microphytoplankton parameters and Harmful Algal Bloom” developed by Herrera-Silveira & Morales-Oleda (2009), and the TRIX index developed by Vollenweider et al. (1998).

The Menhinick, Evenness and Abhab (abundance of harmful species) indices would be the most discriminating for qualifying oligotrophic tropical water masses at large spatial scale but not at the scale of the present study. Only indices integrating the autotrophic (and not...
heterotrophic) compartment provide relevant information on the state of health of the two systems studied. It is obvious that the trophic status of the environment is very crucial and it is necessary in future to develop other indices based on threshold for oligotrophic waters.