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MONITORING OF PLANKTON COMMUNITY DURING A FIELD SCALE BIOREMEDIATION TEST IN A TUNISIAN TOURIST PORT

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ABSTRACT

Ports are critical environments due to their strategic location between sea and land. They receive pollution from land, ships and the port facilities themselves. Moreover, tourist ports are subject to seasonal anthropogenic impacts. Hydrocarbon contamination associated with boat traffic and related facilities poses major concerns for human health and coastal ecosystems. Being harbour partially closed environments, port structures may determine a detrimental reduction in water circulation within the water body. This study was carried out within MAPMED, a multidisciplinary project aimed at improving the environmental sustainability of tourist ports in the Mediterranean Sea with regard to monitoring and reduction of hydrocarbon pollution. Port El Kantaoui was selected as case study site for a field scale demonstration of bioremediation technology in the water compartment. Port El Kantaoui is an artificial marina situated on the Tunisian eastern coast within an international tourist centre, which means that tourism activities are the main impacts on the port area. At this site, the MAPMED consortium carried out an exhaustive characterization of the pollution status and the ecological properties in different port sectors and seasons (winter, at the beginning and at the end of the tourist season). The present study aims at describing the limiting factors to hydrocarbon degradation by autochthonous bacterial communities and defining the links and trade-off between abiotic and biotic elements of the system.

Four stations were selected within different port sectors intended for different usages (leisure boats, fuel station, and port entrance). The sector hosting leisure boats, located in the inner part of the port area, was split into two areas, one for the implementation of the bioremediation treatment and the second one acting as an untreated control. A bimonthly monitoring program has been implemented over one year in order to define the seasonal variation in the physico-chemical and biological parameters as well as the effect of the remediation treatments on the different components of plankton (bacterioplankton, phytoplankton, and zooplankton). The measurement of the physico-chemical seawater parameters (temperature, pH, dissolved oxygen, salinity) as well as the determination of nutrients (ammonia, nitrate, nitrite, and phosphate) and chlorophyll concentrations have been carried out at each sampling station along with the plankton sampling. Total petroleum hydrocarbon have been also evaluated. A polyphasic approach has been adopted in order to define the bacterioplankton communities, exploiting both culture based and culture independent methods. The MPN technique was employed to enumerate bacteria able to grow on diesel, hydrocarbon mixture representative of contaminations resulting from maritime transport. The total counts by DAPI and the viable title of heterotrophs has been also determined. The structure of prokaryotic community has been evaluated by 16S rRNA analysis. Preliminary data derived by the first six month monitoring (before the implementation of the bioremediation treatment) demonstrated that the stations selected as treated and untreated areas do not show any significant difference in physico-chemical parameters as well as microbial titles. A certain degree of spatial and seasonal biodiversity and abundance fluctuation was observed for phytoplankton and zooplankton. A decreasing gradient of dissolved oxygen and hydrocarbon degraders were observed from the port entrance to the inner part of the port during summer. Determination of the other parameters and data elaboration are currently in progress.

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