ENUMERATION OF FECAL INDICATOR BACTERIA, IN CALVI BAY (CORSICA)

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Abstract
Man-induced pressures are very important on Mediterranean ecosystems. In order to check the accuracy of the use of faecal bacteria as indicator of anthropic contamination, we assessed them in contaminated and uncontaminated areas of the Calvi Bay (Corsica, France).
Keywords: Bacteria, Western Mediterranean, Sewage Pollution

Introduction - More than 70% of the world's human population lives in watersheds that drain to the coast. Further population growth will be centered in these regions, exerting unprecedented pressure on riverine, estuarine and coastal habitats receiving human pollutants [1]. The Mediterranean Sea is not an exception. Considering its high species diversity and endemism rate, it is one of the richest marine regions of Europe [2]. However, this unit is ecologically vulnerable due to man-induced pressures. Therefore, it is important to check the accuracy of existing methods and to develop new ones more effective to study and counteract man-induced loss of aquatic ecosystem biodiversity, water quality and recreational resources. In this context, microbial bioindicators play a major role in detecting and characterizing these changes. Indeed, microorganisms are generally highly sensitive to and heavily affected by environmental perturbations. They have fast growth rates, and respond to low levels of pollutants as well as other physical, chemical, and biotic environmental changes [3]. Among them, faecal bacteria are used worldwide as indicator of water anthropic contamination, they are used to assess the potential health risk of pathogenic organisms presence in recreational and aquacultural waters [4]. Faecal coliform and faecal Enterococci are recommended by the European Union and the US Environmental Protection Agency (EPA) because they are found specifically in warm-blooded animal faeces [5] and not present in non polluted sites.

Material and methods - The bacterial community was studied at two sites of the Calvi Bay, in Corsica (France); at the sewer in the port of the Station de Recherches Sous-marines et Océanographiques (STARESO) and 30m outside STARESO's port, on a patch of sand considered clean and unaltered by the sewage. Samples were collected at different depth and four times a year (April, May, July and November 2009*). Different methods were used; epifluorescence with acridine orange staining to enumerate the total bacteria, and 3M™ Petrifilm™ for aerobic mesophilic flora, Enterobacteriaceae, Coliforms and *Escherichia coli*.

Results and discussion - In July, total bacteria number at the sea surface level of the sewer (Fig. 1-A) was twofold higher ($4.10^5 \pm 3{,}1.10^4$ Bacteria/ml) than in April ($2.10^5 \pm 1{,}4.10^4$ Bacteria/ml) and was more constant at the bottom level (Fig. 1-B), with values comprised between $7{,}2.10^4$ and $1{,}2.10^5$ bacteria per ml throughout the sampling campaign. Comparatively, results were less variable and bacteria are less abundant (Fig. 1-B) on the patch sand, except in April in the *Posidonia* matte, where there were $4{,}2.10^5 \pm 1{,}5.10^5$ Bacteria/ml.

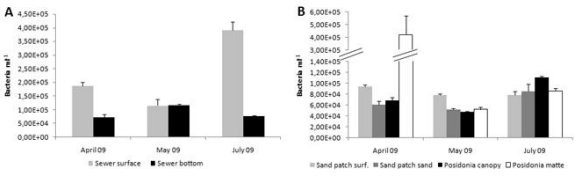

Fig. 1. Variation of bacteria number per ml at the sewer (A) and at the patch sand (B) counted by epifluorescence with acridin orange staining (mean ± SD).

3M™ Petrifilm™ analysis (Fig. 2) showed that there were fewer bacteria identified in April comparatively to May and July. This could be explained by the low presence of scientists and tourists in the station during this period. We can also observe that the abundance of aerobic mesophilic bacteria was still more marked at the sewer (Fig. 2-A and B) than at the patch of sand (Fig. 2-C,D,F and E) for all sampling periods. This difference was also highlighted by the presence of a greater number of Enterobacteriaceae, Coliforms and *Escherichia coli*. Surprisingly, these bacteria were also found in smaller number in the matte and in the canopy of *Posidonia oceanica* meadow next to the sand patch. These biota may be more conducive to abundance by protecting against predators, increasing nutrient and organic carbon availability and providing colonisable surfaces than in the water column [6].

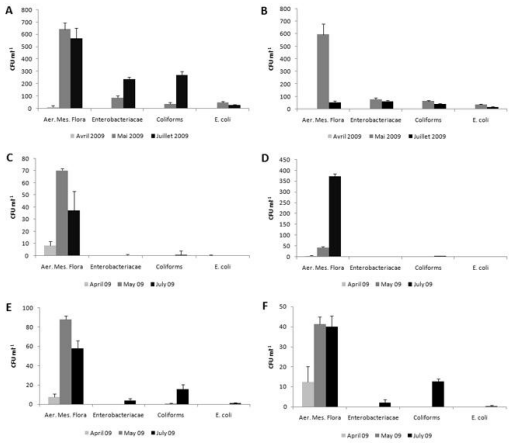

Fig. 2. Variation of aerobic mesophilic flora, Enterobacteriaceae, Coliforms and *Escherichia coli* CFU per ml at the sewer surface (A) and bottom (B) and at the patch sand surface (C), bottom (D), *Posidonia* canopy (E) and *Posidonia* matte (F) with 3M Petrifilm test (mean ± SD).

Conclusions - These preliminary results show the applicability of 3M™ Petrifilm™ for analysis of marine samples. Nevertheless, further analyses have to be done to check the accuracy of this product. Moreover, it seems that some faecal bacteria are able to survive in *Posidonia* meadow. Therefore, new bioindicators must be developed to detect water anthropic contamination. In this context, *Bangiophyceae* could be a potential candidate.

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