Analysis of the microbial community of the river Tiber in different contamination points along its course

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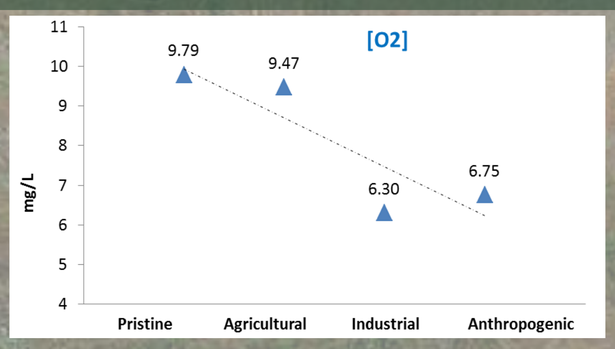
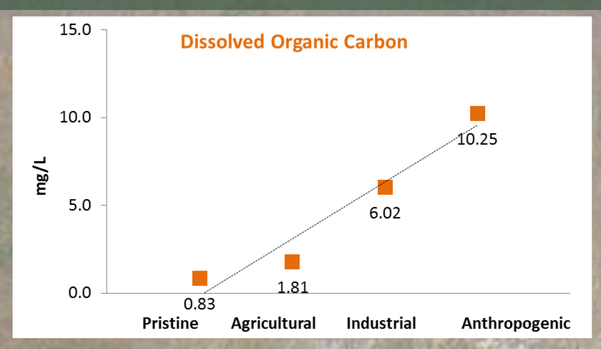
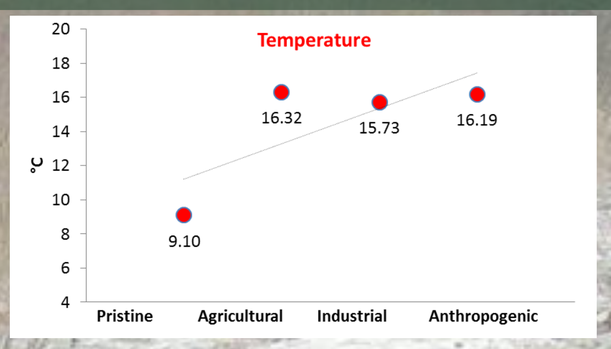
One of the major issues in freshwater quality assessment is finding a link between the chemical and ecological status of a water system. Filling this gap is a new challenge for finding new biological indicators, by integrating multiple stressors, to describe/assess water quality thoroughly. In this context, the main aim of the MicroCokit FP7-PEOPLE-2012-IAPP Project is to identify microbial community based indicators for monitoring and evaluating different types of anthropogenic and environmental pressures.

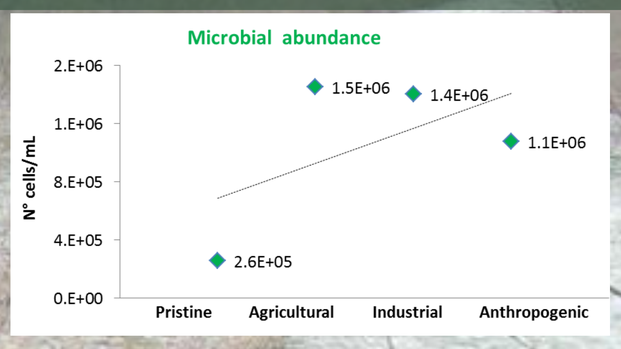
CASE STUDY: the river Tiber was selected and four different sampling sites along its course have been chosen and sampled in Autumn and Spring for 2 consecutive years. Except the **pristine river source (control)**, the other three selected sites were differently exposed to anthropogenic pressures: **Agricultural, Industrial and Anthropogenic one**, respectively.

Chemical (inorganic elements, DOC, PAHs, organochlorine, triazine, chloroacetamide pesticides, perfluorinated compounds, pharmaceuticals, etc.) and **Microbiological analysis** (bacterial abundance by DAPI counts and phylogenetic analysis by Fluorescence In Situ Hybridization) have been performed.



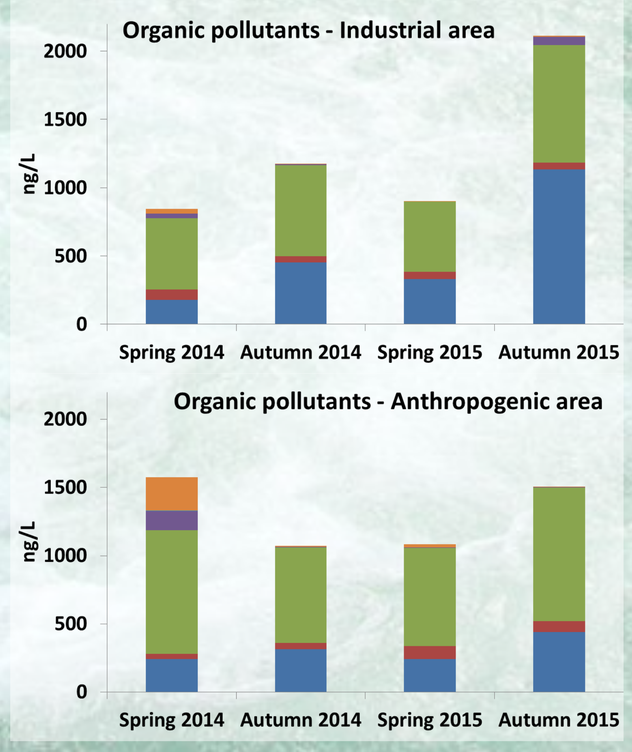






The main physical-chemical parameters and total microbial abundances reflect the spatial gradient, with O_2 decreasing and DOC and bacterial number increasing from river source to mouth.

Table 1	Organic contaminants analysed:
Pesticides	2,4-D, Metolachlor, MCPA, Terbutryn, Terbutylazine
Biocide	Irgarol
Perfluorinated compounds	PFOS, PFOA, PFBS, PFHxA, PFHpA, PFNA
Corrosion inhibitors	1H-Benzotriazole, 5-Methyl-1H-benzotriazole
Polycyclic Aromatic Hydrocarbons (PAHs)	Naphtalene, Acenaphtene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benzo(a)Anthracene, Crhysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, Dibenz(ah)anthracene, Benzo(g,h,i)perylene, Indeno(1,2,3cd)pyrene
Pharmaceuticals and Insect Repellents	Diclofenac, Sulfamethoxazole, Oxazepam, Carbamazepine and metabolite; DEET



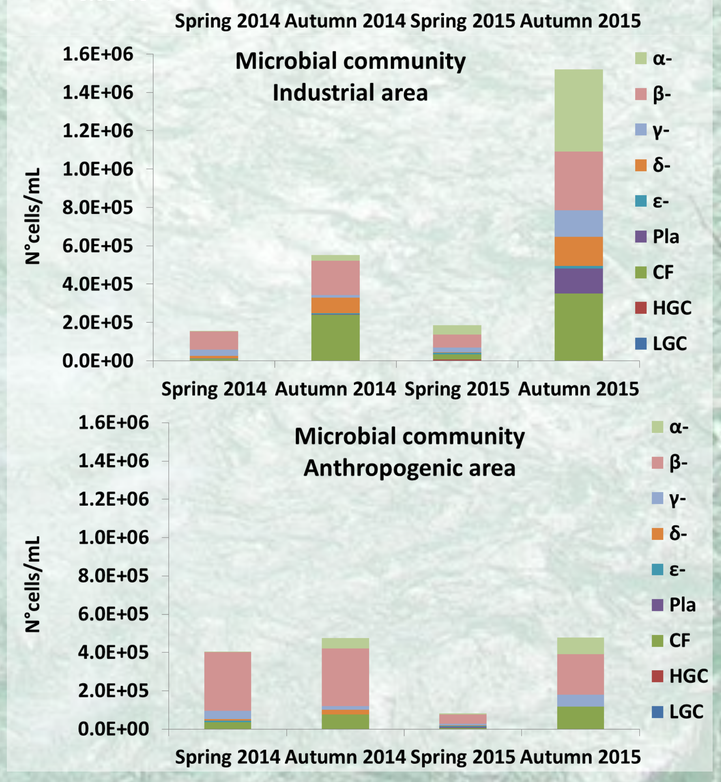


Table 2. Main bacterial taxa analysed

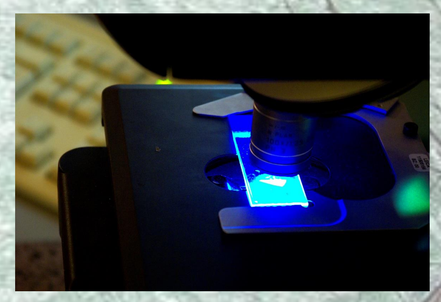
α-	Alpha-*Proteobacteria*
β-	Beta-*Proteobacteria*
γ-	Gamma-*Proteobacteria*
δ-	Delta-*Proteobacteria*
ε-	Epsilon-*Proteobacteria*
Pla	*Planctomycetes*
CF	*Bacteroidetes*
LGC	*Firmicutes*
HGC	*Actinobacteria*


M. Fumaiolo: pristine area


Attigliano: agricultural area


Aniene: industrial area


Scafa: anthropogenic area



Microbial abundance and diversity are related to DOC availability and temperature in the pristine and agricultural sites, while in the industrial and anthropogenic ones abundance and diversity are negatively affected by the sum concentration of specific class of contaminants. Pharmaceuticals and corrosion inhibitors do not influence directly the bacterial structure, while perfluorinated compounds, pesticides and PAHs seem to affect the occurrence and relative abundance of some bacterial groups.

Overall results of four sampling campaigns show changes in microbial community structure which reflect both natural environmental variations such as river course and seasonality, and the different sources of contamination.

Acknowledgments

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Microbial Community-based sequencing analysis linked to anthropogenic pressures: MicroCoKit to address the water quality