A new methodology to assess antimicrobial resistance of bacteria in coastal waters; pilot study in a Mediterranean hydrosystem

Abstract

The global resistome of coastal waters has been less studied than that of other waters, including marine ones. Here we develop an original method for characterizing the antimicrobial resistance of bacterial communities in coastal waters. The method combines the determination of a new parameter, the community Inhibitory Concentration (c-IC) of antibiotics (ATBs), and the description of the taxonomic richness of the resistant bacteria. We test the method in a Mediterranean hydrosystem, in the Montpellier region, France. Three types of waters are analyzed: near coastal river waters (Lez), lagoon brackish waters (Mauguio), and lake freshwaters (Salagou). Bacterial communities are grown *in vitro* in various conditions of temperature, salinity, and ATB concentrations. From these experiments, we determine the concentrations of ATB that decrease the bacterial community abundance by 50% (c-IC_{50}) and by 90% (c-IC_{90}). In parallel, we determine the taxonomic repertory of the resistant growing bacteria communities (repertory of Operational Taxonomic Units [OTU]). Temperature and salinity influence the abundance of the cultivable bacteria in presence of ATBs and hence the c-ICs. Very low ATB concentrations can decrease the bacterial abundance significantly. Beside a few ubiquitous genera (*Bacillus*, *Pseudomonas*, *Shewanella*, *Vibrio*), most resistant OTUs are specific of a type of water. In brackish water, resistant OTUs are more diverse and their community structure less vulnerable to ATBs than those in freshwater. We anticipate that c-IC measurement combined with taxonomic description can be applied to any littoral region to characterize the resistant bacterial communities in the coastal waters. This would help us to evaluate the vulnerability of aquatic ecosystems to antimicrobial pressure