Picoplankton distribution across the Gulf of Naples (Italy)

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Picoplankton, including heterotrophic and photosynthetic microbes smaller than 5 micron in Equivalent Sphaerical Diameter (ESD), are a fundamental component of the plankton. They are considered as independent from larger phytoplankton, representing a constant background, strictly controlled by grazers.
In this study, conducted within the framework of the European Project BIOcean5D, we explored the annual dynamics of picoplankton across seven stations in the Gulf of Naples, spanning coastal to offshore conditions. Samples were collected every three months from July 2023 to May 2025 and analyzed by flow cytometry. Photosynthetic groups, including Synechococcus spp., Prochlorococcus spp. and Picoeukaryotes, were discriminated based on their scatter and chlorophyll and/or phycoerythrin fluorescence signals, while heterotrophic prokaryotes were quantified after SYBR Green staining and distinguished according to relative DNA content.
Picophytoplankton communities showed marked seasonal and spatial variability. Synechococcus spp. reached maximum concentrations in summer, possibly linked to reduced grazing pressure under high-temperature conditions, whereas picoeukaryotes broadly followed the seasonal dynamics of larger phytoplankton and their concentrations were correlated with chlorophyll concentrations. Heterotrophic prokaryotes displayed ephemeral peaks at a station close to the river Sarno, probably related to local freshwater inputs and related organic matter mediated by meteorological conditions (e.g. rain).
While a minor component during the spring phytoplankton bloom, picoplankton contributes to a significant percentage of total biomass in the summer and oligotrophic periods, as revealed using conversion factors. These results highlight the ecological relevance of picoplankton in coastal systems and its sensitivity to both seasonal dynamics and local land-derived inputs.