



The use of fossil benthic foraminifera to define reference conditions for present-day marine waters

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The implementation of legislations is generating a fruitful debate amongst marine scientists about how to define efficient and reliable bio-assessment tools to monitor the ecological quality status (EcoQS) of marine waters. According to those legislations, EcoQS assessment needs a “reference condition” with which to compare the present-day condition at a site. The fossil record has a potential to reconstruct PaleoEcoQS and thereby establish in situ reference conditions from pre-impact times. Unlike most macrofaunal groups which are the most commonly used biological quality indicator in these environments, benthic foraminifera leave a fossil record and therefore allow the reconstruction of human-induced environmental disturbance over decades to centuries. Foraminifera have the potential to serve as ecosystem characterization tools in modern and past marine environments. We compared the response of benthic foraminifera, macrofauna and selected environmental parameters from the same sites in areas with relatively stable salinity and temperature conditions but otherwise contrasting environmental properties (e.g., varying degree of anthropogenic impact). In August 2008, replicate samples for living (stained) benthic foraminifera and macrofauna from 27 stations in 11 silled fjords along the Norwegian Skagerrak coast were examined. Environmental data (bottom-water dissolved-oxygen, TOC, TN and pigments) were analysed for each station. The same kind of data were analysed from 2 recolonisation sites in the inner Oslofjord. In addition, the PaleoEcoQS during the past century was reconstructed using benthic foraminifera and selected environmental parameters from 11 stations in the inner Oslofjord. Results show that living benthic foraminifera are at least as reliable to define present-day EcoQS as conventional methods. Fossil benthic foraminifera can also define ecological status of reference conditions from pre-impacted times. This is not possible using conventional methods. Consequently, benthic foraminifera are excellent bioindicators of human-induced environmental impacts over time.