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Building capacities for 'omics' observations in the ocean at high spatiotemporal resolution

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Analyzing the distributions and activities of marine organisms with metagenomic, metatranscriptomic, and other 'omic' techniques holds great potential in the observation of marine biodiversity and functions. When applied to microbial communities, such approaches are able to capture the multi-faceted responses of marine microbes to natural and anthropogenic pressures and the connected impacts on element cycling including fixation of inorganic carbon and dinitrogen. Ocean time-series and regular transects have delivered a strong foundation of knowledge of marine biogeochemistry. However, the imperative of characterizing the organisms that underly elemental cycles in times of rapid global change is hindered by the low resolution of human- and ship-based observation programs. The benefit of introducing omics-based investigations into ocean observation efforts has been recognized by several institutions and projects running observing programs (e.g., PAP, HAUSGARTEN, CPR, Tara Oceans) and by international initiatives and networks in the field (e.g., GOOS, MBON, LTER, NEON, GLOMICON). In order to establish omics observations as a component of routine observation of the open ocean there is a strong need for technologies that allow for unattended sampling with autonomous platforms as well as for automated shipbased sampling that may be carried out with research vessels and ships of opportunity. Activities to build capacities for omics-based observations were carried out in the framework of the EU FP7 projects AtlantOS and EnviGuard, with a focus on unicellular planktonic organisms that are poorly – or not at all – identified by morphology-based taxonomic techniques,. These efforts focused on the development and validation of new sampling technologies, on the investigation of the performance of different preservatives available to store samples, in situ, for the period of sampler deployments, and on the application of omics methods to samples collected with off-the shelf sampling equipment. In this context, this presentation introduces the new 'AUTOmated FIltration system for marine Microbes' / AUTOFIM and 'Marine Autonomous Plankton Sampler' / MAPS samplers, informs about the approach and first outcomes of a comparison of both standard preservatives and specific agents for molecular studies, and shows some examples of omics observations carried out in Fram Strait by means of particle traps and moored water samplers as part of the FRAM observatory infrastructure in the HAUSGARTEN area.