Tools for Rapid Biodiversity Assessment in the deep-sea: an overview

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Rapid biodiversity assessment (RBA) refers to time efficient tools that allow to collect information on the present biodiversity in a given area. RBA is never an exhaustive inventory and will not record every species in an area; it would typically target specific groups, such as particular size classes (micro-, meio-, macro- or megafauna), specific taxa or functional groups (specific trophic levels, key species, habitat engineers,..) for which methods will differ according to organism size, habitat and distribution, among other biological characteristics. RBA in terrestrial environments is often based on key taxa (e.g., specific bird or mammal species) that are used as proxies for the health and integrity of ecosystems. In the deep sea however there is no information on key taxa available yet. Furthermore using a rapid method may imply a quality loss in comparison to traditional methods where more time is given to identify specimens to the lowest taxonomic level. Only when RBA methods are guaranteed to give the same or at least similar level of information as the validated taxonomic expert-based methods they can be applied in a monitoring or an Environmental Impact Assessment (EIA) program. If this is not the case, they should be applied with caution, especially in remote deep-sea systems where key taxa or functional groups, or particularly vulnerable taxa or indicator taxa are not yet identified.

During MIDAS several emerging RBA tools that are potentially applicable to address effects of deep-sea mining on biota living in these ecosystems were tested with a focus on the seafloor-associated biodiversity since here the impacts are expected to be severe due to the removal and disturbance of the substrate. We identified two main categories for rapid biodiversity assessment for sea-floor associated biota. The first category refers to non-invasive, imaging-based techniques such as high resolution video or photographic image surveys. The second category is based on material of collected specimens where the present biodiversity is assessed through molecular and/or morphological techniques. In general, image-based assessments are restricted to larger morphological features. Hence they typically only cover diversity of epifaunal macroscopic organisms (megafauna). On the other hand, imaging techniques also provide visual information over larger stretches of the habitat. Using this information, biodiversity patterns may be connected to characterizations of the natural habitat or mining-related disturbances. The sampling-based methods may allow to combine detailed morphology and molecular analysis of organisms, although some analysis are destructive and do not allow an integrative approach. Their spatial/temporal coverage will be lower within a given time frame, but the methods potentially cover a wide taxonomic/functional representation of groups, and may target both epi- and endofauna, typically with a focus on small organisms. In case of sediment samples, analyses of organisms may be accompanied by detailed physical and chemical analyses at a small spatial scale.