Assessing feasibility and best practices of zooplankton observations with the Video Plankton Recorder in coastal turbid waters

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Zooplankton is of great importance to our marine ecosystems and is traditionally sampled through net sampling techniques. The use of discrete net samples however has limited spatio-temporal coverage and can destroy delicate organisms. The Video Plankton Recorder (VPR), provided through the LifeWatch observatory, offers a solution: the VPR is essentially an underwater microscope that records images of particles from 100µm up to a few centimetres. As photographs are made in the water column, the VPR has the advantage that it can observe living and delicate plankton such as gelatinous zooplankton (e.g. jellyfish), colonial forming organisms (e.g. Phaeocystis) and other fragile particles (e.g. marine snow) without damaging them. The VPR can be used in conjunction with CTD measurements and the collected images can be linked to location and depth to determine the relative contribution of environmental conditions on the dynamics and 3D distribution of plankton.

In general, the VPR is towed in clear, low turbidity waters such as Atlantic or Arctic environments. The Belgian Part of the North Sea (BPNS) is however characterized by very different conditions, with the biggest concern being the high turbidity zone near the coast as field observations indicate that a high turbidity can hamper the use of the VPR. Because turbidity varies with seasons, it was first investigated when and where the VPR can be used in the BPNS. The working limit of the VPR was determined by sailing through different turbidity zones. This limit was linked to suspended particulate matter (SPM) and Secchi depth measurements, proxies for turbidity, taken on the same campaign. Using LifeWatch data-series on SPM and Secchi depths, monthly and yearly maps with the deployment area for the VPR were developed. They showed that the high turbidity areas near the coast and the Scheldt Estuary have to be avoided. Adversely, the low turbidity areas offshore and on the western part of the BPNS, can be visited practically year round. Secondly, it was investigated which tow types and magnifications provide the most valuable information on the plankton community and abiotic environment and for which studies this can be useful, with a focus on monitoring programs. During deployment, the VPR is towed behind the research vessel on a dedicated winch that allows to undulate the VPR through the water column or to keep it at a fixed depth. The depth of the VPR, sailed trajectory and magnification can be chosen by the scientist depending on the research question and can heavily affect the VPR's measurements.

Three tow types and four magnification settings were compared between themselves, and were among others scored on practicality, plankton abundance, number of plankton taxa, ability to distinguish (a)biotic patterns and image quality. For monitoring purposes, it is suggested to deploy the VPR in an undulating way while sailing in a straight line. This way, the whole water column is sampled and both horizontally and vertically valuable (a)biotic data can be collected in which gradients and patterns are recognizable. Using the second highest magnification avoids that too large or small organisms are missed, while still having sufficient image detail whereas the lowest magnification are capable to observe larger gelatinous species, which are destroyed by net samples. Progress was made regarding the knowledge, feasibility and best practice of the VPR in coastal turbid waters such as the BPNS. We can conclude that the VPR can be an added value for future plankton research and monitoring.

Keywords: Zooplankton; Optical imaging techniques; Turbidity