Manual for Marine Monitoring in the

COMBINE

Programme of HELCOM

Part C

Programme for monitoring of eutrophication and its effects

Annex C-3

Sediment traps

ANNEX C-3 SEDIMENT TRAPS

1. INTRODUCTION

Due to increased new production during the process of eutrophication export of organic matter from the euphotic zone to the sediment surface is enhanced. Concomitantly species composition in the pelagic community may undergo changes, which will be reflected in the composition of vertical flux.

2. PURPOSE

The purposes for recording the time varying vertical particle flux with sediment traps at some selected stations in the Baltic Sea are:

- to measure the seasonal patterns in the flux and its interannual variability
- to record trends in quantity and composition of the flux
- to reconstruct pelagic events such as blooms and occurrence of species from year round fluxes.

3. SAMPLING STRATEGY OF VERTICAL PARTICLE FLUX

A clear pattern of seasonal flux events can be expected related to events of primarily new production with little pelagic consumption such as after spring and fall blooms as well as sporadic blooms. Year round sampling of vertical particle export will allow to identify time and duration of bloom events as well as phytoplankton species composition from frustules and/or biochemical markers such as alkenons or pigment products. Moreover, given a trap deployment in anoxic waters, to where no living zooplankton penetrates, trap collection will allow an estimation of zooplankton mortality. The fate of cyanobacterial blooms, whether they are consumed in the pelagic foodweb or are largely exported to the seafloor, will be followed. Enumeration and possible identification of resting stages will supplement species analysis from water column samples.

The main strategy of sediment trap deployment is to obtain a year round record on proxies for pelagic events which normally escape detection by frequent ship sampling alone. Emphasis should be given to qualitative aspects, as in the narrow Baltic Sea basins resuspension and lateral transport may falsify quantitative estimates during some periods. The Bornholm and Gotland basins are chosen for sampling sites.

An ideal sediment trapping protocol would define rigorous guidelines on trap design, deployment, sample collection methods, sample processing, analytical methods and calculations. However, there is a general consensus that due to the paucity of data which enable one to quantitatively compare the relative merits of different designs and techniques the present state-of-the-art does not yet justify strict protocols. Further, it is hardly to envisage a rigorous protocol for the different environments of deployment and complex variability of sample types.

4. SAMPLING

Cylindrical or funnel-shaped traps should be used, which fulfil the basic hydrodynamic requirements that particles which have entered the trap will not be washed out of the trap. Cylinders with a minimum aspect ratio of 5:1 and funnel-shaped traps equipped with a baffle of the same aspect ratio will be suitable. Multi-traps with a turn-table for several sample containers for which individual sampling time can be preset for any time interval from days to months are preferable.

The traps should be deployed below the halocline and sufficient distance to the sea-bottom to minimise the effects of resuspension.

The minimum temporal resolution should allow a continuous recording during the deployment period and provide sufficient material for the respective analysis of the samples. A monthly resolution for winter months and a bi-weekly resolution for the pelagic growth period is recommended as a minimum. Trap design allowing a weekly resolution is preferable at the beginning and towards the end of the growth period.

Sampling containers of the trap should be filled with filtered water from the deployment depth.

During long deployment times a preservative is essential to avoid microbial degradations of the samples and to prevent activities of swimmers. Formaldehyde appears to be the most suitable compromise in terms of effectiveness and prevention of swimmer fragmentation.

5. POST-DEPLOYMENT PROCEDURES

5.1 STORAGE

Immediately after trap recovery sampling containers are stoppered tightly and are kept under refrigeration in the dark until separation of particles from the supernatant solutions.

5.2 SWIMMER-HANDLING

By definition swimmers are organisms, i.e. zooplankton, that have entered the trap actively rather than by passive sinking. In trap collections from oxic waters swimmers cannot be differentiated from passive animal fluxes. These organisms must be picked from the samples before further handling of trap material for flux estimates.

Zooplankton picked from trap samples from deployment in anoxic waters can be expressed as zooplankton flux provided that the existence of living zooplankton in the anoxic layer above the trap can be excluded by regular water column sampling with nets.

5.3 OPTICAL INSPECTION OF TRAP COLLECTION

Before subdivision for various analyses the wet sample is inspected and qualitatively described using a dissecting microscope.

5.4 SUBDIVISION OF SAMPLES

No rigorous protocol can be followed for the splitting procedure. This will largely depend on the results of the optical inspection. Sieving of samples for size-fractionating should be avoided as fragile particles are destroyed by these procedures and thus fractionation is of no use.

Any subsamples should be a discrete aliquot of the entire sample, the amount will be dependent on the minimum quantity required for the respective analysis.

For microscopical analysis wet splitting is to be conducted. For bio-chemical particle characterisation, such as dry mass, carbon, nitrogen and phosphorus species, biogenic silicate, a large wet subsample should be desalinated and freeze dried with subsequent subsampling by weight.

6. ANALYSIS

Analyses from trap samples should include at least the determination of

- dry weight
- total particulate C, N and P
- microscopic investigation of particle composition including phyto- and zooplankton

(UNESCO, 1994) and is to be carried out according to the BMP Manual unless composition of trap material dictates otherwise

7. CALCULATIONS

The downward vertical flux of any particle and particulate component is defined as the quantity of that particle or that component through a horizon in a given time. Flux is calculated from the sample diameter of a given trap and exposure time of the respective sampling container and expressed in units of quantity per horizontal area per time.

REFERENCE

UNESCO, 1994. Protocols for the Joint Global Ocean Flux Study (JGOFS). Core Measurements. IOC Manuals and Guides 29: 170 pp.