

Assessing sediment toxicity in reservoirs before flushing: developing a protocol for freshwater in Italy

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Introduction: Desiltation is often necessary in reservoirs to maintain the storage capacity and in Northern Italy it is frequently achieved by sediment flushing.



Fig. 1: Sediment flushing

These operations may determine a release of contaminants (e.g., trace elements, PAHs) from resuspended sediments, determining potential toxicity to aquatic organisms living in the downstream river [1]. Based on case studies in Lombardy Region, characterized by different degrees of silting and anthropogenic pressures, a protocol for chemical and ecotoxicological characterization of sediments in reservoirs (PrATo) was developed for a proper management of flushing operations [2]. This approach has been adopted in Lombardy in the Technical Guidance for the Reservoir Management Plans [3]. However, there is still much to do to improve its applicability in different regions and to select proper criteria for environmental risk assessment. The main constraints and potential solutions are here addressed.

Methods: PrATo includes standard protocols for sampling, chemical and ecotoxicological characterization of sediments in reservoirs and in the downstream river. It is based on an approach similar to TRIAD, taking into account: 1) chemical analysis of (micro)pollutants in sediments and elutriates; bioaccumulation in native macroinvertebrates can be also analyzed; 2) sediment toxicity analysis using test batteries; 3) results can be combined with the ecological assessment of aquatic communities in the downstream river. The protocol is applied *before* flushing, as basis for planning proper operations for

minimizing the risk of detrimental effects in the river. For example, a safe sediment:water dilution factor to be applied during flushing can be calculated, preventing the exceedance of toxicity thresholds. The same characterization is performed on sediments collected in the downstream river *after* flushing to assess potential alterations.

Results and discussion: Some focal points of the protocol still need to be defined. The main constraints and potential solutions are:

- background concentrations of contaminants and toxicity are generally unknown: quality guidelines can be selected from existing national legislation or from literature, but the analysis of a “reference” site located upstream from each reservoir is also necessary as a site-specific criterion.
- the number of sampling points, surveys and analyses for each case study is limited because of cost/beneficial constraints, therefore a strict statistical approach can't be generally adopted for evaluations. Rather, proper screening and risk thresholds need to be defined.
- in a first version, only one sediment-contact test was performed (with the ostracods *H. incongruens*), but some false positives or negatives limited its effectiveness. Test batteries have been adopted for a more robust evaluation [4].
- the different lines of evidence need to be properly combined to obtain a final judgment. A translation into operational guidelines for reservoir managers is needed.

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