# The WoE approach applied to the sediments characterization to the lagoon environment: the Venice Lagoon case

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**Introduction:**
Venice Lagoon, measuring 500 square kilometres, is among the most extended ones in the Mediterranean basin. It is about a century that the lagoon has been affected by a progressive process of morphological degradation caused by the increased strength of the tidal currents, the relative sea level rise, and the erosive action induced by internal navigation. In order to reverse the degradation process several interventions have been done in the last 30 years aimed at the reconstruction of the salt marshes and mudflats by using sediments coming from dredging of lagoon channels. This was possible thanks to the adoption in 1993 of a protocol for managing sediments based on a chemical characterization carried out on reference values for about ten substances (heavy metals, PAHs, etc.). In 2017 a general review process of the protocol dated 1993 was undertaken with the aim of reaching a new protocol coherent with the more updated knowledge and in compliance with the EU Directives. Attention was then given to the possibility of adopting a WoE approach based on a chemical and ecotoxicological characterization. Bioaccumulation assessments was included in the of reallocation sediments in lagoon water bodies.

**Methods:** The sediment and bioaccumulation analytical, chemical and ecotoxicological results, available from the MODUS project implementing the Water Frame Directive in the period 2012-2016, and from the project HICSED in 2008, were used to build a database aimed at verifying the suitability of the chemical reference values L1 and L2 adopted in 2016 for the Italian marine environment.

As for the chemical characteristics overall 7124 data were used unevenly distributed among metals and trace elements, IPA, and other relevant organotin compounds. As for the ecotoxicological aspects, the results related to 892 biological samples, divided in two types of batteries, were inserted into the database. Totally, 7 organisms with 8 different protocols were used so to gain a good ecological representativeness of the studied environments in terms of taxa, tested matrices, and measured points.

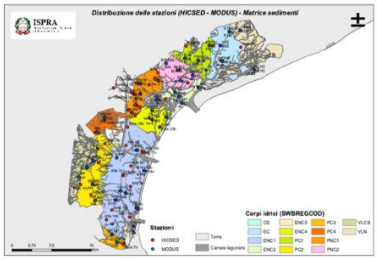


**Fig. 1:** Location of the sampling stations of the projects MODUS e HICSED.

**Results:** L1 values, largely coincident with the standards of environmental quality (SQA) required by the Italian legislation for transitional waters in coherence with the Water Framework Directive (WFD). Their adoption is also supported by the available bioaccumulation data. As for the L2, the low concordance with the collected chemical and ecotoxicological dataset shows a poor adeguacy for the management of lagoon sediments in case of handling. The consequent process of statistical derivation of chemical values with a local reference according to the Probable Effect Level criterion, enabled the identification of alternative limits, overall more realistic than the specific characteristics of lagoon sediments [1], [2]. The chemical and ecotoxicological evidence is expressed through Hazard Quotients and specific indexes provide a quantative estimate of the environmental hazard [3] [4] [5]. The indexes are put within hazard classes taking into account both the chemical evidence and the eco-toxicological evidence. In this way, 5 classes of sediment were definied compatible management options inside to the lagoon.

**Discussion**: To complete the definition of those values for which the dataset features did not enable the derivation of local L2, the database should be implemented by means new chemical and ecotoxicological characterisations of sediments sampled within those areas with higher levels of contamination and toxicity. For those parameters having local values lower than L1 deep analyses are necessary to consider the hypothesis of the SQA value review, i.e. the possibility of readjusting the

environmental standard according to the value of natural background.

Up to the dataset completion, for the scientific profile of the substances for which it was not possible to identify L2 values, an approach was adopted according to the precaution criteria established by the WFD that fixes a 20% tolerance for the SQA values.

This approach ensures coherence both with the evidence so far ascertained through the present study and the general setting of the proposal of a new protocol for the management of the Venice Lagoon sediments.

**References:**

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