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Non-traditional isotopes (Cu, Zn, and Hg) applied in bivalve mollusks for marine pollution biomonitoring: a “Mussel Watch” programs upgrade

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Over the last two decades, Cu, Zn, and Hg stable isotopes have been applied as tracers for pollutant sources in aquatic compartments. However, their use in suitable biomonitor organisms remains scarce. In marine environments, metal stable isotope compositions in bivalve mollusks are of great interest to environmental marine management programs such as the ‘Mussel Watch Program’. Globally abundant, sessile, and laboratory easy handle filter-feeders, these organisms have long been used as low-cost biomonitors of metal bioavailabilities trends in the marine environment. In this work, we test the application of non-traditional isotopes in mussel and oyster species from monitoring sampling stations from the national French “Mussel Watch” program in coastal systems under different pollution contexts. The obtained results show that mixing source isotope systematics in sediment and water can be transposed to bivalves. The previous knowledge on isotope fractionation in coal, metallurgic, and industrial processes allows identifying isotope patterns in biomonitoring network sampling stations and using mixing source models to perform source apportionment at regional and global scales. These findings confirm the utility of metal isotope information for supporting environmental management strategies in marine biomonitoring programs.