

# Mercury stable isotopes discriminate different populations of common Seabass around Europe and provide insight on mercury cycle

Cransveld Alice<sup>1</sup>, Amouroux David<sup>2</sup>, Tessier Ammanuel<sup>2</sup>, Bérail Sylvain<sup>2</sup>, Barre Julien<sup>2</sup>, Michel Loïc<sup>1</sup> and Das Krishna<sup>1</sup>

<sup>1</sup> Laboratory of Oceanology, MARE, University of Liège, Allée du 6 Août , B6C, 4000 Liège, Belgium  
E-mail: [alice.cransveld@doct.ulg.ac.be](mailto:alice.cransveld@doct.ulg.ac.be)

<sup>2</sup> IPREM-LCABIE, UMR 5254 CNRS, University of Pau, Hélioparc, 2 avenue P. Angot, 64053 Pau, France

In a context where worldwide emission of mercury, a global pollutant, are increasing, research for new tools and data enabling a deeper understanding of mercury fluxes and sources are crucial. Over the past few years, the analysis of stable isotopes of mercury has emerged as a new promising technique affording to explore the Hg cycle, somewhat like what is being done for the carbon and nitrogen cycles. Hg can exhibit both mass-dependent (MDF, reported as  $\delta^{202}\text{Hg}$ ) and mass-independent fractionation (MIF, reported as  $\Delta^{199}\text{Hg}$ ). While MDF may occur during biological cycling *inter alia* and could be used to understand bioaccumulation processes, MIF provides a unique fingerprint of specific chemical pathways, such as photochemical transformations. In this context, information provided by Hg isotopes would help to improve environmental management strategies. However, so far, few studies considered Hg isotopes in marine vertebrates.

Our study reports the first data on Hg isotopic composition in marine European fish, for seven distinct populations of the common seabass, *Dicentrarchus labrax*. The combination of  $\delta^{202}\text{Hg}$  and  $\Delta^{199}\text{Hg}$  values enabled us to successfully discriminate several populations and recursive partitioning analyses demonstrated their relevance as discriminating tools. Moreover, mercury isotopic values provided insight on Hg contamination sources for biota and on MeHg cycling. We showed that  $\delta^{202}\text{Hg}$  in seabass muscle is probably a good integration of the  $\delta^{202}\text{Hg}$  of MeHg in their diet, except when concentrations are low, in which case *in vivo* processes would significantly influence the  $\delta^{202}\text{Hg}$  in fish muscle. The  $\delta^{202}\text{Hg}$  was also linked with known Hg point sources in several sites and the overall range of  $\delta^{202}\text{Hg}$  around Europe was suggested to be related to global atmospheric contamination.  $\Delta^{199}\text{Hg}$  in seabass was shown to reflect the level of contamination of fish and their habitat but not only. MIF was also clearly influenced by ecological characteristics of fish and their habitats, and therefore could be used to identify and investigate peculiar Hg environments such as in the Black Sea. Throughout this study, results from the Black Sea population stood out, underlying the particularities of Black Sea Hg which seemed to display a Hg cycling similar to what is observed in fresh water lakes.

Data on Hg sources and levels in Europe are scarce and Hg cycling is still poorly understood. Our findings constitute the first large scale isotopic analyses of Hg in the area. They bring out the possibility to use mercury isotopes in order to discriminate distinct populations, to explore the global Hg cycle on a large scale (Europe) and to identify particularities in the Hg cycle of several sites. The interest of using mercury isotopes to investigate the whole European Hg cycle is clearly highlighted by our results.

Keywords: mercury sources; stable isotopes; Europe; fish