

# The effect of salinity on the acute toxicity of copper and cadmium in European sea bass *Dicentrarchus labrax* L.

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Contamination by heavy metals in aquatic environments is a serious concern due to increasing human activities over the last decades. Moreover, productive areas such as estuaries have even been more affected because of the complex interaction between fluvial and marine processes, creating a stressful environment with gradients of salinity and other important parameters which can intensify negative effects of pollutants on biota such as euryhaline fish (Mieiro *et al.*, 2012; Oliva *et al.*, 2012). European sea bass (*Dicentrarchus labrax* L.) is an euryhaline species able to withstand a large variation in salinity and is considered as a bioindicator due to both economic and ecological importance (Loizeau, 2001; Schnitzler *et al.*, 2011). Copper as essential micronutrient has important roles in cellular, enzymatical and protein mechanisms but is potentially toxic when its concentration increases above a certain threshold (Blanchard and Grosell, 2005; Grosell *et al.*, 2007), and can even be more toxic than cadmium, a non-essential metal (Roméo *et al.*, 2000) which is ubiquitous in environment and one of the most deleterious heavy metal pollutants (Nath *et al.*, 1984 cited by Loaiza, 2011). Therefore, the effect of salinity on the acute toxicity of copper and cadmium in European sea bass *D. labrax* L. was examined to determine 96h-LC50 values (the lethal concentration where 50% of the population dies) at different exposure concentration of both metals (at 0 to 5100 $\mu\text{gCu.l}^{-1}$  and at 0 to 20000 $\mu\text{gCd.l}^{-1}$ ) over a broad salinity range (1, 2.5, 5, 10, 20, 28, 35‰) in juvenile sea bass during a period of 10 days. The results showed an important influence of the salinity in the toxicity in both elements, where for Cu mortality first decreased with increasing salinity but increased again at higher salinities and for Cd, mortality decreased continuously with increasing salinity, to a point where no reliable LC50 could be determined at the 2 highest salinities. In addition, it was observed that the individuals were affected in different ways. For instance Cu exposed fish at low salinity showed opened gills at die-off. Copper is readily taken up by the gill, where it inhibits the action of Na<sup>+</sup>/K<sup>+</sup> adenosine triphosphatase, resulting in an osmoregulatory disturbance as Na<sup>+</sup> is lost to the dilute external environment (Blanchard and Grosell, 2006). In conclusion, the salinity influences the toxicity differently for Cu and Cd. This not only occurs due to the fact that salinity plays an important role in the speciation of pollutants and competition by cations in uptake processes, but as can be clearly seen in the case of Cu, also by the physiology of the fish that responds to the changes in the environment. Further research on the relationship between bio-accumulation of the metals and the mortality at different salinities is planned.

**Keywords:** *Dicentrarchus labrax* L.; salinity; acute exposure.

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