Preliminary evaluation of metal contamination in benthic fishes of the Gulf of Tigullio (north-western Italy)

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Introduction: Some metals, such as Cu, Fe, Mg and Zn, are essential for biological systems, whereas other metals, such as Cd, Hg, and Pb are toxic even in trace concentrations. However, also the essential metals can produce toxic effects at high concentrations [1]. In marine environment, metals present in the bottom sediments enter the food chain via the feeding of benthic species, among which the benthic fishes that are relatively situated at the top of the marine food chain. The metal accumulation and the metal effects in fishes depend on different factors, such as the fish species, preferences of habitat, trophic level, behaviour, sex, age, size, and the duration of metal exposure [2]. Fish are widely used to evaluate the health of aquatic ecosystems and physiological changes serve as biomarkers of environmental pollution [3]. The present study, part of a larger research that involves interactions between abiotic and biotic components, aims to give a first characterisation of benthic fishes that live in marine bottom sediments of the eastern Gulf of Tigullio (north-western Italy) contaminated by high ecotoxic metal concentrations derived from the Acid Mine Drainage of the abandoned Libiola Fe-Cu sulphide mine (Sestri Levante; [4]), and evaluate how the metals may affect the benthic fish community.

Methods: 42 fishes were caught in three different areas between the mouth of the Entella Torrent and the mouth of the Gromolo Torrent (Fig. 1) in the Gulf of Tigullio at a depth of 5-30 m, during the period Nov-Dec 2016. Fish were sacrificed in an excess of anesthetic (MS222, Sigma-Aldrich) directly on board, and tissues (gills, liver and kidney) were fixed in a Bouin's solution for 24 hrs and stored in alcohol (70%) for histological analyses. Histopathological alterations were qualitatively described in 5µm thick sections, stained with haematoxylin (H&E), Mann Dominici and Periodic Acid Schiff (PAS). At the end of the analyses, the most reliable morphological endpoints were selected for each tissue for further studies.

Results: The caught fishes belong to different families: *Triglidae, Trachinidae, Mullidae, Serranidae, Bothidae, Sparidae, Labridae* and *Carangidae* (the last pelagic). The nature and severity of the lesions in gills, liver and kidney of sampled fish are presented in this study and compared to the occurrence of metals in sediment. Microscopic examinations revealed injuries to gill (mucous cell proliferation, edema with intense lamellar vasodilatation), liver (melano-macrophage centres (MMCs) and structure alteration) and kidney (MMCs and inflammatory cells) tissues. Some differences between species were observed.

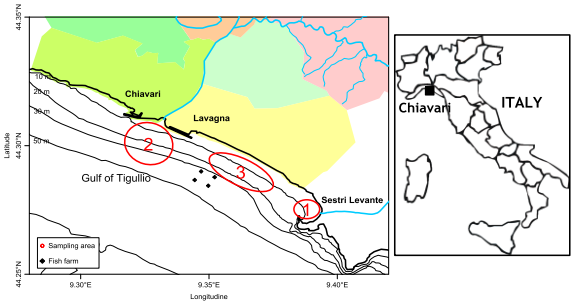

Fig. 1: Study area and sampling areas: Gulf of Tigullio (north-western Italy).

Discussion: The results obtained are the first characterisation carried out in the study area and will let deepening the knowledge on the metal impact on the benthic fish community. When exposed to toxic concentrations of heavy metals, fish may accumulate pollutants in their tissues, undergoing morphological alterations. Thus the investigation of histological changes in organs of fish is an accurate way to assess the effects of pollutants [5]. This is confirmed also in this study where histopathological features, often associated with heavy metal exposure such increased mucous secretion in gill, and MMCs occurrence in liver and kidney were observed in fish sampled. The histopathological alterations selected in this study will be scored also on further samples to assess a wider semi-quantitative evaluation of the effects of metal exposure on tissues in this area.

References: [1] Alturiqi and Albedair (2012) *Egyptian Journal of Aquatic Research* **38**:45–49; [2] Velusamy et al. (2014) *Mar Pollut Bull* **81**:218–224; [3] Authman et al. (2015) *J Aquac Res Development* **6:**1-13; [4] Capello et al. (2016) *Mar Pollut Bull* **109**:128-141; [5] Vinodhini and Narayanan (2009) *Int J Environm Res* **3**:95-100.