Metal pollution effect in fluvial ecosystem: trophic transfer and early effect detection

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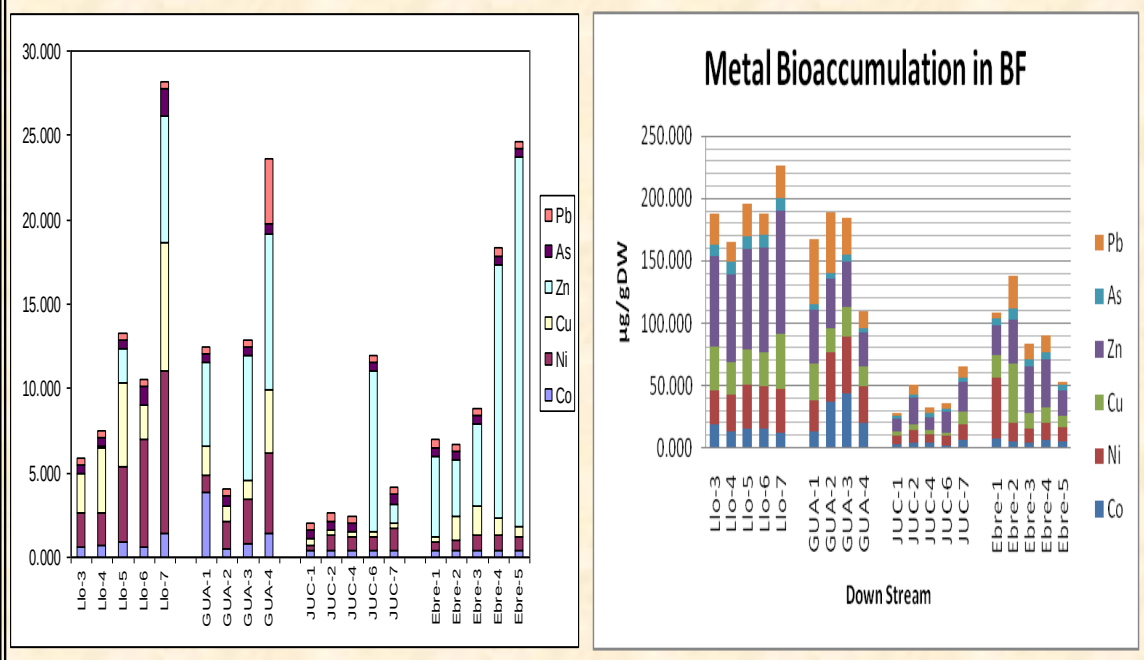

Figure 1.Water metal concentration (in µg/L) and biofim metal concentration in the 15 river sites sampled .

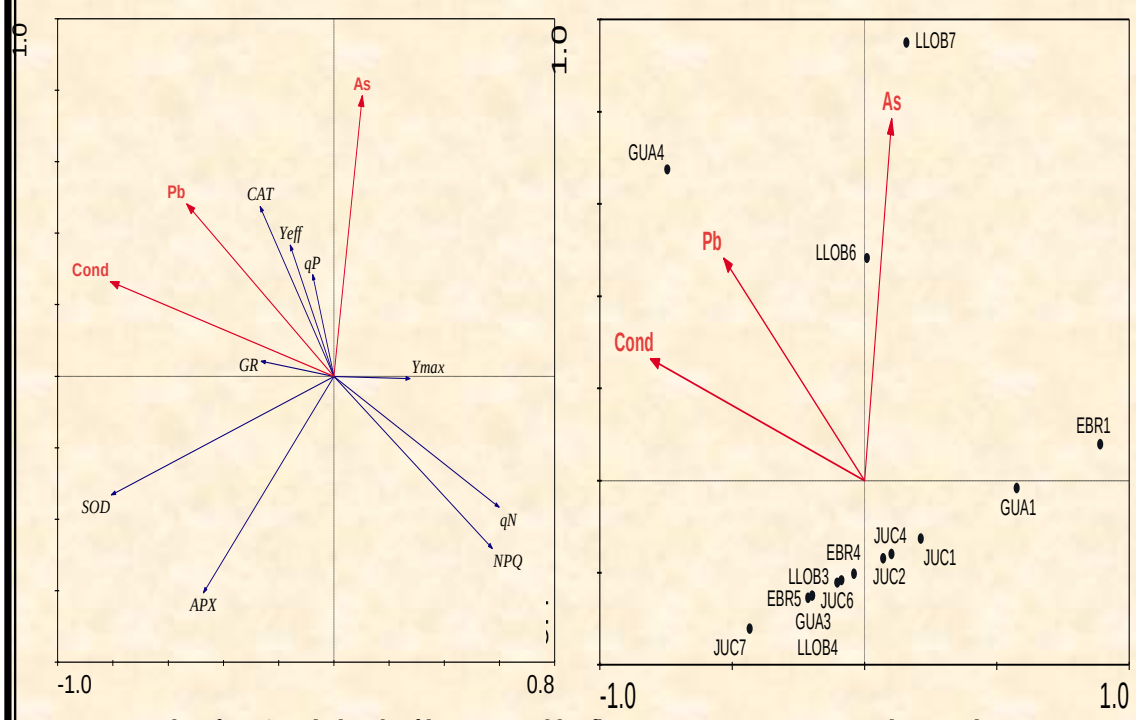

Figure 2.Results of RDA including biofilm metrics chl-a fluorescence measurements and antioxidant enzyme activities, as well as environmental variables: physical and chemical parameters, metal concentrations in water and in biofilm.

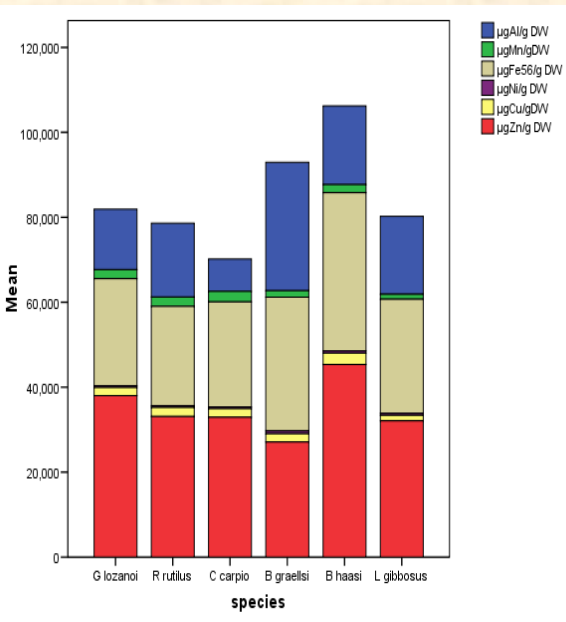

Figure. 3.Metal bioaccmululation in fish muscle. Mean values of Al, Mn, Fe, Ni, Cu, Zn for the six fish species sampled.

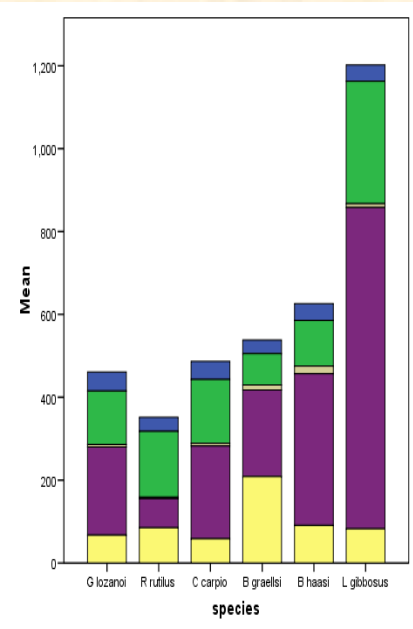

Figure.4. Metal bioaccumulation in fish muscle. Mean values of Co, As, Cd, Hg, Pb for the six fish species sampled.

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References: Romani et., al 2010, Burton et al., 2002, Rao and Padmaja, 2000; Bervoets et al., 2001 , Guasch et., al 2010, Sabater et., al 2010,

Introduction-

Biofilms are complex communities composed of green algae, diatoms (brown algae), cyanobacteria, bacteria, protozoa and fungi; these micro-organisms live closely together embedded in an extracellular matrix.

Algae have been found to be more sensitive than animal species to a variety of potential contaminants, including cadmium, copper, nickel, and zinc and thus, they are frequently used in phytotoxicity tests.

Fish are at the high trophic level of the food web and may accumulate large amounts of some metals from the water and often in concentrations several times higher than in the ambient water.

Keywords-Metal Pollution, Biofilm, Fish, AEA (Antioxidant Enzyme Activity), ICP-MS, CANOCO., etc.

Objectives-

To explore the relationship between different types of stress and the structure and physiological performance of biofilms growing in different Mediterranean rivers.

To determine the bioaccumulation of metals in the organ (muscle) of fresh water fish and compare the metal accumulation with the different processed data and finally try to know the response of metal accumulation with the different morphological and physiological characteristics of fish.

Results and Discussion-

Water metal content showed also an upstream-downstream gradient being the Llobregat the most polluted. On the other hand, metal contents in terms of potential toxicity (CCU units), was higher in GUA 4, where Pb levels were maximum. In terms of metal bioaccumulation in biofilm the most bioaccumulated river is Llobregat.

Relation between metal pollution and biofilm responses

RDAs performed without applying the variance partitioning technique selected Pb (p=0.139), Conductivity (p=0.02) and Arsenic (p=0.007) as the three significant variables, accounting for 52.6% of variance. The high Pb concentration found in GUA4 matched with high CAT activity, indicating an induction of antioxidant activity in response to the prevailing environmental stress.

Moreover, the variance partitioning analysis attributes a significant part of variance to metal pollution, being Pb the significant variable and CAT activity and the maximum yield the most related biofilm metrics, suggesting that Pb might be the metal responsible for the observed biological responses.

The different fish species have preferences in the metal accumulation capacity. The order of metal accumulation in the fish *Gobio lozanoi* is Zn>Fe>Al>Cu>Mn and the other rest species pattern (*Rutilus rutilus, C. carpio, B. graellsi, B. hassi, L. gibbosus*) have the same metal accumulation.

Concerning metals found at lower concentration in the fish *Gobio lozanoi* the order of metal accumulation is following in this way Hg>As>Pb>Co>Cd, but in the fish *R rutilus* the most accumulated metal is As>Pb>Hg>Co>Cd, and *C. carpio* is following the same way like *G lozanoi.* In the *B. graellsi* the most accumulated metal is Pb>Hg>As>Co>Cd. In the fish *B hassi* the most dominated accumulated metal is in the order of Hg>As>Pb>Co>Cd. In the fish *L gibbosus* the dominated accumulated metal is Hg>As>Pb>Co>Cd.

In terms of total metal accumulation in graph (ppt) the fish species is following is the order like *L gibbosus, B hassi, L graellsi, B carpio, B lozanoi, and R rutilus*.

Conclusions-

Based on the samples analyzed, metal concentrations found in the muscles of different fishes in the present study following the ranking of metal bioaccumulation in the muscles of different fish species is Zn>Fe>Al>Cu>Mn>Ni (µg/g d. w) and Hg>As>Pb>Co>Cd(ng/g d. w). In the present study It has been found that the small fishes have more metal bioaccumulation in comparison of big fishes. High levels of metals were found in muscle of *B. hassi* and *Lepomis gibbosus* while the lowest levels in muscle of species *R. rutilus* and *C. carpio*. On the other hand the metal bioaccumulation in the biofilm was following the ranking Zn>Ni>Cu>Pb>Co>As.

Pyramid of trophic transfer (biomagnifications) of metals Pb, Cu in Llob-3z