

# Combining metal and stable isotope analyses to disentangle contaminant transfer in a freshwater community dominated by alien species

Paride Balzani<sup>1,\*</sup>, Phillip J. Haubrock<sup>2,3</sup>, Francesco Russo<sup>1</sup>, Antonín Kouba<sup>3</sup>, Peter Haase<sup>2,4</sup>, Lukáš Veselý<sup>3</sup>, Alberto Masoni<sup>1</sup>, Elena Tricarico<sup>1</sup>

<sup>1</sup> Department of Biology, University of Florence, via Madonna del Piano 6, 50019 Sesto Fiorentino (Italy), \*paride.balzani@unifi.it

<sup>2</sup> Senckenberg Research Institute and Natural History Museum Frankfurt, Department of River Ecology and Conservation, Clamecystrasse 12, 63571, Gelnhausen, Germany

<sup>3</sup> University of South Bohemia in České Budějovice, Faculty of Fisheries and Protection of Waters, South Bohemian Research Center of Aquaculture and Biodiversity of Hydrocenoses, Zátíší 728/II, 389 25 Vodňany, Czech Republic

<sup>4</sup> University of Duisburg–Essen, Faculty of Biology, Universitätsstraße 5, 45141 Essen, Germany

## WHAT

Freshwater alien species can bioaccumulate high metal concentrations (Gherardi et al. 2002), potentially transferring them along the food web. These species can modify the communities' trophic structure, leading to new interactions (Haubrock et al. 2019) with contaminants transfer following new pathways. Heavy metals transfer within highly invaded communities is scantily studied.

## HOW

We analysed the concentration of 14 heavy metals of 11 species, mainly alien, present in the Arno River (Central Italy). To assess the pathway of contaminants within the community, metal and carbon/nitrogen stable isotope analyses were coupled. Using stable isotopes and Hg as a third diet tracer (Ballutaud et al. 2019), we estimated the diet and compared to that one reconstructed with stable isotope only.

## RESULTS

Crustaceans showed higher metal concentration than fish, except for Cd, Hg and Se higher in fish (Fig. 1). A considerable biomagnification along the trophic chain was found for Hg, while other metals biodiluted (Fig. 2).

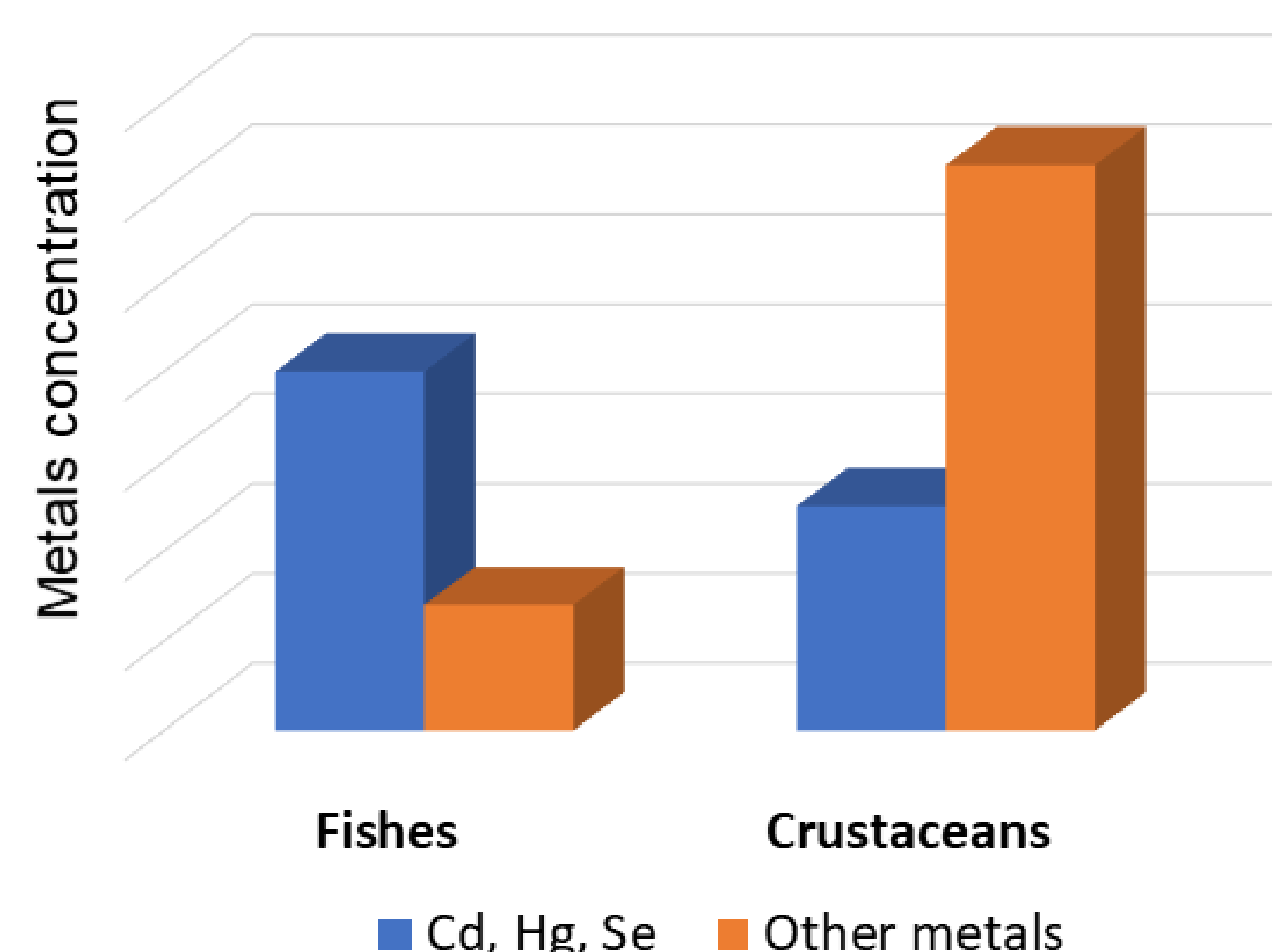


Fig. 1

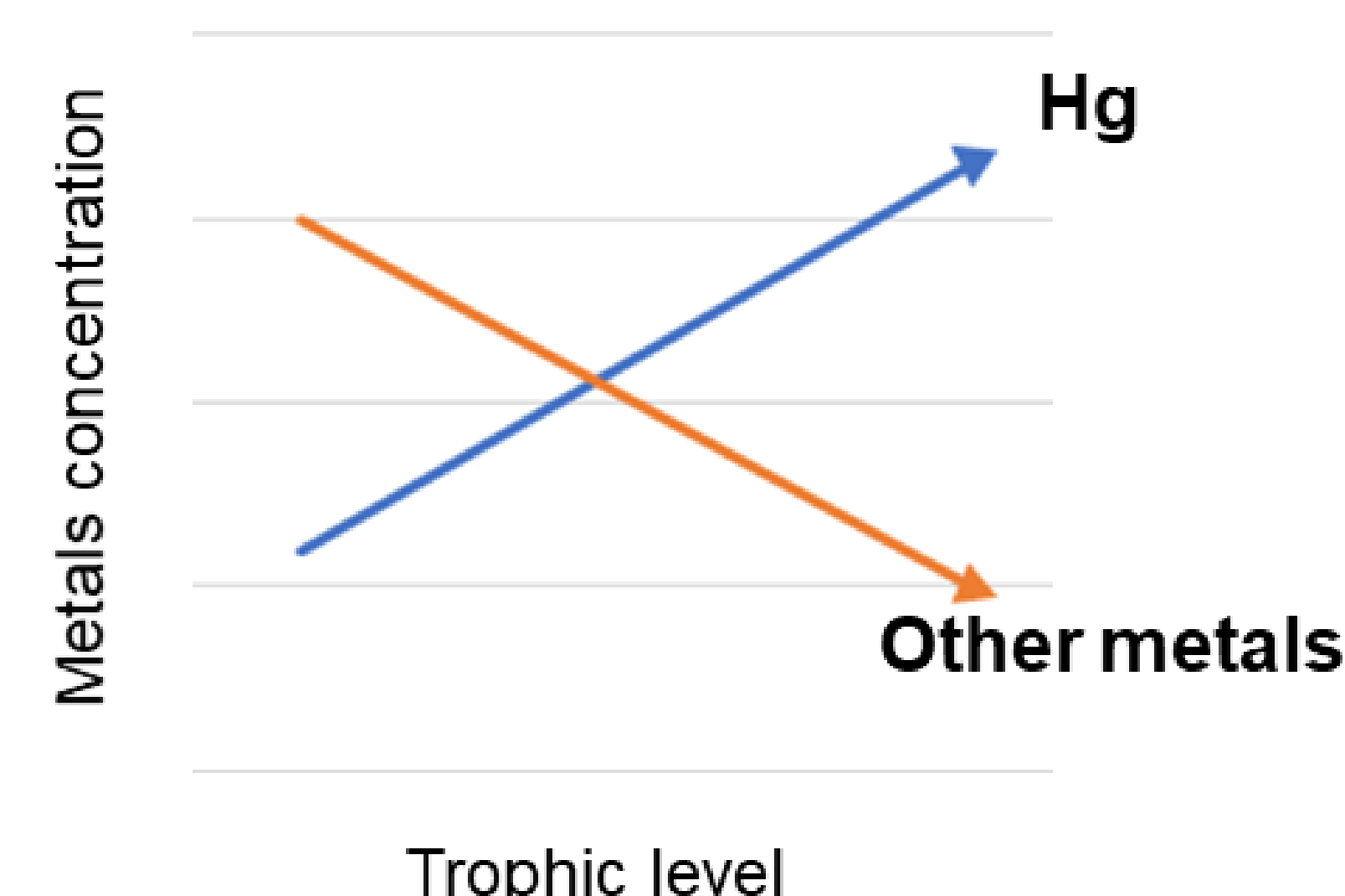


Fig. 2

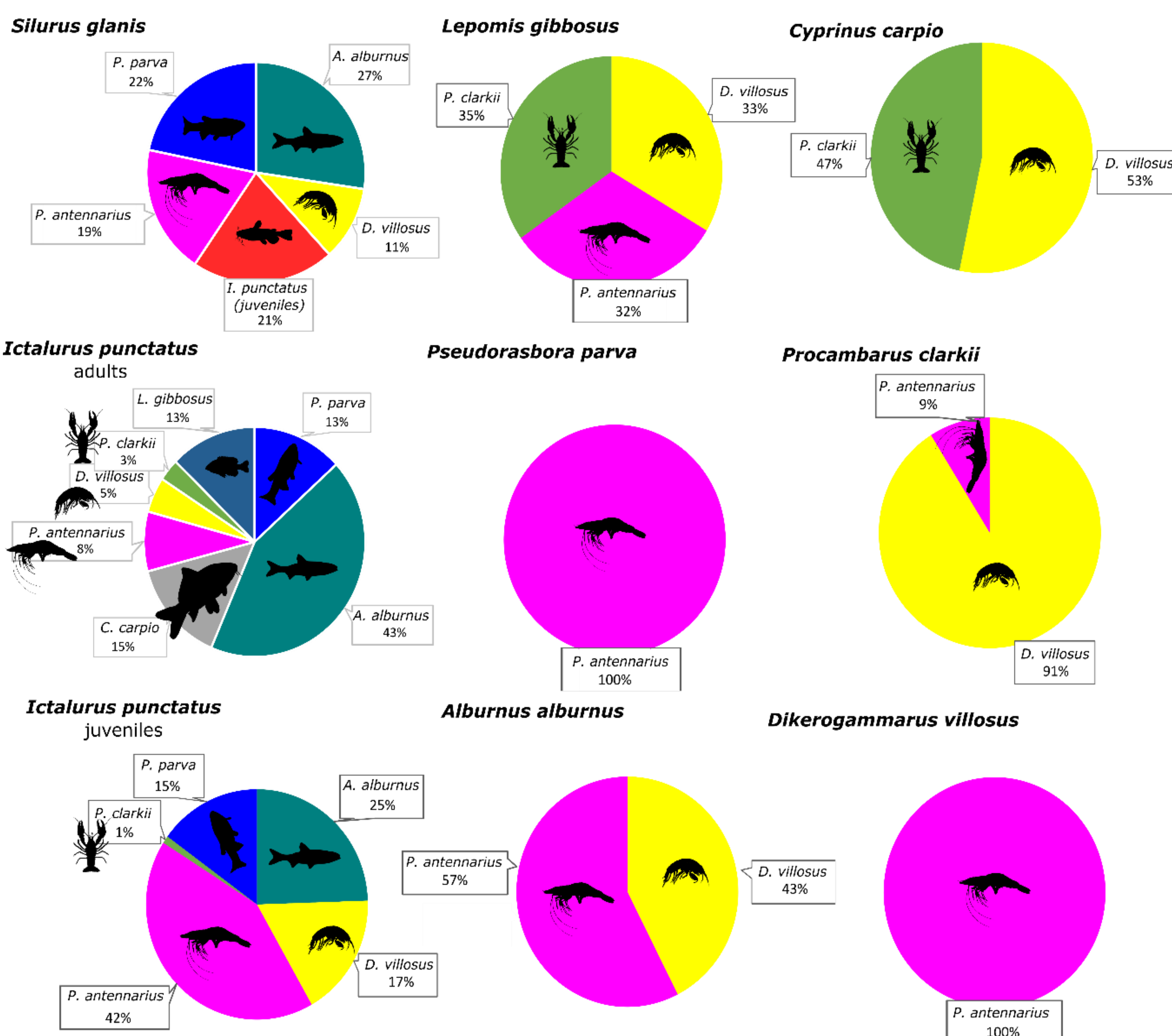


Fig. 3

Fish consumed crustaceans as a significant proportion of their diet but did not show higher metal concentration than crustaceans themselves (Fig. 1,3).

## CONCLUSIONS

- The diet estimated combining both stable isotopes and Hg concentrations (Fig. 3) provided finer results compared with that estimated with stable isotopes only.
- Metal accumulation in the Arno River community was relevant, even if biomagnification was found only for Hg.
- Environmental filtering and increased competition may contribute to the disappearance of native species with lower tolerances.