

## Mixture and Individual Effects of a Herbicide and a Metal on Marine and Estuarine Planktonic Species

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Marine and estuarine water pollution usually results from discharges of combined chemicals near the areas with high anthropogenic activity. Understanding mixture effects is of great importance as it may enhance the biodiversity losses. Moreover, there still exist an important knowledge gap on the toxicity resulting from multi-stress scenarios, and therefore potential synergistic effects that may arise are ignored. Thus, this study address single and equitoxic mixture effects of two formulated compounds - the herbicide Primextra® Gold TZ and the metal copper - by assessing toxicological endpoints in species from two trophic levels: algae growth - marine diatom *Thalassiosira weissflogii* - and immobilization - estuarine calanoid copepod *Acartia tonsa*. Single effects revealed the herbicide Primextra® Gold TZ is considerably more toxic to diatoms:  $EC_{10}=0.001$  (0.0008 – 0.0013),  $EC_{20}=0.002$  (0.0015 – 0.0022),  $EC_{50}=0.005$  (0.0041 – 0.0051) mg/L, than to copepods:  $EC_{10}=0.684$  (0.003 – 1.314),  $EC_{20}=1.003$  (0.036 – 1.860),  $EC_{50}=2.087$  (0.944 – 12.578) mg/L, whereas the metal copper is in general more toxic to *A. tonsa*:  $EC_{10}=0.057$  (0.021 – 0.093),  $EC_{20}=0.100$  (0.051 – 0.150),  $EC_{50}=0.296$  (0.200 – 0.522) mg/L, than to *T. weissflogii*:  $EC_{10}=0.174$  (0.074 – 0.273),  $EC_{20}=0.200$  (0.107 – 0.294),  $EC_{50}=0.256$  (0.120 – 0.392) mg/L. Considering the equitoxic mixture, planktonic species revealed different sensitiveness. Individual compounds are slight more toxic to *T. weissflogii* than the mixture of both chemicals. An opposite trend was observed to *A. tonsa* where the mixture was more toxic than the single exposure. Overall, the great sensitivity differences observed within species did not allow the conclusion that one trophic level is more tolerant than the other. On a whole, further studies are needed toward a comprehensive understanding of organic and inorganic compounds mode of action, their effects at lower biological-level endpoints, and under different mixture designs.

**Keywords:** Mixture and single bioassays, diatom, copepod, herbicide, metal