A BAYESIAN MIXTURE MODEL FOR ESTIMATING INTER-GENERATION CHRONIC TOXICITY

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Better understanding of toxic effects on biological populations across generations is crucial for determining the long-term consequences of chemical pollution in the marine environment. In addressing this issue it is important that we develop appropriate statistical methods for analysing complex multi-generation experimental data. Here, we demonstrate the application of a Bayesian mixture model to assessing the effect of multi-generation copper (Cu) toxicity on the reproductive output of the harpacticoid copepod, *Tigriopus japonicus*, using experimental data across three generations. By using a mixture model we were able to explicitly model inter-generation effects of Cu exposure on the two processes contributing to reproductive output in this species: the ovisac deposition rate, and the number of nauplii per ovisac. This is in contrast to more traditional statistical approaches that model reproductive output as a single process. The advantages of our approach are that it allows more subtle hypotheses about the effects of chemical toxicity to be tested and it correctly models the statistical distribution of the data, leading to more reliable inferences. We applied the model and an information theoretic approach to examine the impact of current- and previous-generation exposures to Cu on copepod reproductive output. The results clearly demonstrate inter-generation effects of Cu exposure on both the ovisac deposition rate and the number of nauplii per ovisac. An individual's reproductive output was reduced when either it, or its parents, were exposed to Cu, but there was little evidence for a grandparent effect. There was also some evidence for resistance to Cu exposure when an individual's parents had been exposed to Cu. However, negative parental exposure effects, for individuals that were not exposed to Cu, suggests that there is a cost associated with this resistance. The mixture model presented provides a robust framework for making inferences from data of this kind.