

Individual organisms in pelagic ecosystems can be expected to encounter frequent changes in food abundance, quality and toxicity. Copepods are well-adapted to persist under these variable conditions, and their success can be attributed to adaptations such as dormancy as well as changes in growth, reproduction and physiology to maintain their fitness. However, little is known about how copepods respond physiologically to environmental stressors like harmful algal blooms. Here, we used RNASeq to investigate gene expression patterns in *C. finmarchicus* feeding on a toxic alga. In the Gulf of Maine, the calanoid copepod *Calanus finmarchicus* co-occurs with the toxin-producing dinoflagellate *Alexandrium fundyense*. Gene expression was determined after two and five days in adult females feeding on *A. fundyense* at either low or high doses compared with females on a control diet. A significant time and dose dependent response was observed in *C. finmarchicus* with over 1000 of genes differentially regulated. At two days, the response was similar to the cellular stress response. At five days, fewer genes were differentially expressed and the transcriptional response reflected a physiological adjustment towards new environmental conditions with pronounced down regulation of lipid biosynthesis. Surprisingly, detoxification was not a major component of the copepod's response to the dinoflagellate. The results suggest that blooms of *A. fundyense* have an "insidious" effect on *C. finmarchicus*. Although the dinoflagellate does not affect survival, it compromises the copepod's energy budget even in the low dose treatment, which could lead to a potential depression of copepod production.