

Modelling – alternative resource for oil risk assessment?

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Crude oil can be introduced into the marine environment via natural seeps and/or human activities. Events like the Deepwater Horizon oil spill show the need to assess the effects of crude oil on marine biota. Quantitative information on the effects of oil on ecologically relevant endpoints such as survival and reproduction is important for risk assessment. However, few experimental studies have assessed the impact of oil constituents on these endpoints. Models may be helpful to assess effects of oil on the survival and reproduction of aquatic organisms that have remained untested. Yet, until now, a generic model quantifying accumulation and effects of oil constituents is lacking. The goal of the current study was therefore to develop a model, applicable to a wide range of species, to quantify the bioaccumulation of oil constituents in aquatic organisms and to estimate the corresponding effects on their survival.

We predicted the bioaccumulation based on organism's properties such as wet weight, lipid content and rate constants of the chemical. The octanol-water partition coefficient (K_{ow}) of the chemical was another key model parameter. Predicted body burdens were used in concentration-response functions to calculate mortality rates. To assess their accuracy, we applied the models to published data for different species and oil constituents, and compared our model predictions with observed values.

As an example, we estimated the survival of the amphipod *Hyalella azteca* exposed to five fluoranthene concentrations. The mortality rate predicted by the model was used to simulate the surviving fraction of a *H. azteca* population. Mortality due to fluoranthene is accurately predicted for the highest concentration (250 µg/l) but is underestimated (up to 20% deviation) for the 62.5 µg/L and 125 µg/L treatments. However, considering that the OMEGA bioaccumulation model requires limited data input and that general oil toxicity values were used to predict the effects of pyrene, it can be concluded that this approach shows potential for the data sparse risk assessment of oil.