Oil spills: never mind the droplets

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A common mitigation response after oil spills is the application of chemical dispersants to promote the breakdown of the oil slick into microscopic oil droplets. It has been demonstrated that the size range of these droplets overlaps with the size range of food items of certain aquatic organisms and it is unclear how the dietary uptake of these droplets influences the bioaccumulation of potentially toxic oil components.

Here we assessed to what extent oil droplets enhance bioaccumulation of polyaromatic hydrocarbons (PAHs), typical oil components. To this end, we constructed two allometric bioaccumulation models, one with and one without PAH uptake through ingested oil droplets. Using data from six studies, we tested which of these two models was best in predicting internal PAH concentrations for six species (four fish, one crustacean and one shellfish) exposed to oil dispersions.

In general, the model without oil droplets was able to predict the total internal PAH concentration within a factor of 5 from the observations for all six species. For *Mytilus edulis*, the inclusion of oil droplets in the model resulted in a slightly improved predictive capacity (factor 1.4 instead of factor 2). This is possibly related to the filter feeding mechanism of this species which has a feeding range that strongly overlaps with the size range of oil droplets. The model with oil droplets also resulted in slightly better predictions for the non filter feeding species such as *Scophthalmus maximus, Gadus morhua* and *Pandalus borealis*. These species were possibly exposed to oil droplets attached to food. Interestingly, for *P. borealis*, *G. morhua* and *S. maximus* the inclusion of oil droplets increased model accuracy by lowering the predicted PAH body burdens. This suggests that ingested oil droplets could be an elimination route for PAHs.

Although inclusion of oil droplets in accumulation models caused modest improvements of model predictions, they also caused model output to be more uncertain, as many parameters related to oil droplet ingestion and the transfer of PAHs from droplets to body are uncertain. We conclude that existing bioaccumulation models are sufficiently accurate and precise to predict PAH body burdens following oil spills.