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Dispersants do not increase exposure of cod eggs and larvae to toxins in oil spills

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Oil spills at sea can be catastrophic events, with oil and discharged toxins, including polycyclic aromatic hydrocarbons, threatening marine wildlife and coastlines, damaging healthy ecosystems and harming livelihoods. A recent study found that using dispersants moderately decreased the number of cod eggs and larvae affected by spills off the Norwegian coast.

Efforts to stop widespread damage from oil spills typically involve burning or collecting surface spills, or using dispersants. Dispersants are chemicals that help to break up the oil into smaller droplets, reducing or preventing the ascent of oil droplets from seabed spills, enhancing the mixing of the oil into the water column and making it easier for naturally occurring bacteria to break it down.

The use of dispersants has been controversial, particularly as earlier types were sometimes more environmentally damaging than the oil itself. Newer types of dispersants though are considered less toxic to the environment and are useful in preventing oil slicks travelling to sensitive areas, such as fish spawning grounds or places where there are stationary organisms, like mussels, which cannot escape.

Fish eggs and larvae are highly sensitive to oil toxins, especially polycyclic aromatic hydrocarbons (PAHs). Using dispersants to break up surface slicks increases the concentration of total PAHs (TPAHs) in the water column where the cod eggs and larvae are found, which may increase the toxic effects of an oil spill.

In this study, researchers modelled the fate of oil released from surface spills at three different sites along the Norwegian coast, for 30 days in April, with and without the use of dispersants. They focused on two TPAH thresholds in the water column. TPAH concentrations above 1.0 parts per billion (ppb) of water are expected to kill cod eggs and larvae, while concentrations above 0.1 ppb cause sublethal effects, such as developmental disorders which may over time affect the fish populations negatively.

The researchers also modelled the drift of Atlantic cod (*Gadus morhua*) eggs and larvae released from nine spawning grounds off the Norwegian coast. Combining these models allowed the researchers to determine the exposure of the eggs and larvae to the oil spills, with and without the use of dispersants.

The results showed that dispersants moderately decreased the fraction of eggs and larvae exposed to either lethal or sublethal TPAH concentrations.

Generally, the concentration of TPAHs in the water column became higher when dispersants were used than when they were not used, because the dispersants caused mixing of the oil into the water column. TPAHs were also distributed deeper in the water column with the addition of dispersants than without them. However, the total volume of water contaminated with TPAHs at concentrations that are toxic to eggs and larvae was less when dispersants were used, because dispersants also accelerated the dilution and breakdown of the toxins.

Where the oil was spilled also affected the proportion of eggs and larvae exposed to toxic levels of TPAHs, with northern spills generally affecting more eggs and larvae from all spawning grounds than spills farther south along the coast of Norway.

While the use of dispersants reduced the fraction of eggs and larvae from all spawning grounds exposed to both lethal and sublethal impacts from the oil spill in this study, many factors need to be considered when deciding whether to use dispersants to minimise the environmental impacts of an oil spill. The researchers highlight the importance of understanding the combined effects of the location and timing of the spill and how its fate potentially affects a variety of vulnerable habitats and species.