

Science for Environment Policy

Deepwater Horizon oil causes heart problems in developing fish embryos

The Deepwater Horizon oil spill is likely to have damaged large numbers of tuna and amberjack fish embryos, new research suggests. Fish embryos exposed to oil samples taken during the spill developed abnormalities in their hearts and, consequently, their spines, fins and eyes. This is likely to have caused population declines in these commercially important species, the researchers conclude.

In April 2010 an explosion on the Deepwater Horizon oil rig in the Gulf of Mexico spilled an estimated 636 million litres of oil into the [ocean](#). The resulting oil slicks covered a vast area, reaching around 17 725 km².

Open ocean fish, such tuna and amberjack lay their eggs in the surface waters of the northern Gulf of Mexico. Other studies have found that crude oil, and polycyclic aromatic hydrocarbons (PAHs) in particular, are toxic to developing fish embryos. For this study researchers investigated the impact of the Deepwater Horizon oil spill on the development of yellowfin tuna (*Thunnus albacares*), Atlantic bluefin tuna (*Thunnus thynnus*) and greater amberjack (*Seriola dumerili*). Prior to the oil spill the Atlantic bluefin tuna was listed as endangered by the [IUCN](#) and numbers fell to an all-time low in the Gulf; as a result, populations could be particularly vulnerable to any toxic effects of the oil.

In the laboratory, the researchers exposed fertilised fish eggs of the three species to one of two types of oil samples. The first was collected in 2010 from the oil slick formed during the Deepwater Horizon incident. The second was sourced direct from the damaged wellhead pipe and was then 'artificially weathered' by heating so that the oil concentrations were similar those measured at sea during the oil spill.

As the embryos developed, the researchers took pictures under the microscope to examine the timing and structural development of their hearts. For comparison, some embryos of all three species were developed in clean water.

Even at very early stages of development, the researchers' detected abnormalities in the developing hearts of embryos exposed to oil. This occurred in all three species, for both types of oil at total PAH concentrations less than 15 micrograms per litre (µg/L). These changes were characterised as either swelling of the tissue around the heart or swelling of the whole egg yolk in more severe cases.

Concentrations of total PAHs as low as 2-3 µg/L caused swelling of the tissue around the heart in over half the tuna embryos. As a result of heart failure, the embryos also showed abnormalities of the spine, fins and eyes.

To assess the relative sensitivities of the different species researchers measured the PAH concentrations at which half of the embryos developed swelling around the heart. This occurred at 0.8 µg/L for bluefin tuna, 2.3 µg/L for yellowfin and 12.4 µg/L for amberjack. This suggests that the bluefin and yellowfin tuna embryos might be more susceptible to the toxic effects of the PAHs, possibly as a result of their smaller size.

The researchers also detected a slowing of the heartbeat and irregular heart rhythms in all three species exposed to the oil samples. For instance, PAH concentrations of less than 1 µg/L caused an irregular heartbeat for both yellowfin tuna and amberjack embryos.

The researchers conclude that, as PAH concentrations of up to 84 µg/L were detected during the oil spill, it is likely that large numbers of developing embryos died or suffered defects that would cause early death.



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