

ORD Critical Review of Ortmann et al. (2012) Dispersed Oil Disrupts Microbial Pathways in Pelagic Food Webs. PLoS ONE 7: e42548.

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ORD scientists reviewed the Ortmann et al. (2012) article for technical adequacy and determined that the environmental relevance of the results were highly uncertain. Chief concerns are detailed below and include inadequate oil weathering, inadequate oil and dispersant mixing and characterization, high oil and dispersant exposures in a closed artificial system, and unclear or inadequate sampling and analytical procedures. Overall, the results of this study should not be broadly extrapolated to the Gulf of Mexico because of an apparent lack of environmental relevance to oil and dispersant exposures during the DeepWater Horizon Spill (DWHS) in Gulf habitats.

1) Overview of Ortmann et al. (2012)

Ortmann et al. (2012) used mesocosm exposures to determine how microbial communities collected from coastal Alabama may respond to oil and dispersant mixtures. The exposures utilized replicate static 200 L enclosures of water samples collected near Dauphin Island, AL. Treatments included controls, carbon addition control (glucose), dispersant only (Corexit 9500), oil only (Macondo 252 oil), and oil plus dispersant mixture. The authors reported that the addition of dispersant or dispersed oil resulted in increased heterotrophic prokaryotes, and a significant inhibition of ciliates within the mesocosms. The authors concluded that the results suggested a reduction in grazing and decreased carbon transfer to higher trophic level, and speculated that the addition of dispersant and dispersed oil may have reduced zooplankton and fish production on the Alabama continental shelf.

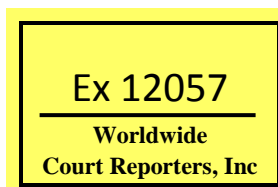
1) ORD Technical Concerns

a) Inadequate Oil weathering

Unweathered oil was used in the mesocosm experiments, rather than using more environmentally relevant weathered oil. It is unclear why unweathered oil was used when offshore oil reaching the surface during the DWHS was weathered, and oil reaching coastal areas was more extensively weathered. Oil weathering has profound effects on oil composition, environmental fate, and effects. The results obtained with fresh oil should not be extrapolated to the conditions in the Gulf of Mexico during the DWHS.

b) Inadequate Oil and Dispersant Mixing and Characterization

The authors reported low mixing of oil into the water column in the oil only treatments, and apparent mixing within 6 hours in oil plus dispersant treatments, with some slick oil visible. Mixing energy within the mesocosms appears to have been unrealistically low based on the authors' visual observations of oil slick dissipation and mesocosm physical descriptions. Unfortunately the authors do not report a more quantitative assessment of mixing energy in the system, nor adequate chemical and physical characterization of the dispersed oil or mass balance of added oil. The results should not be extrapolated to the conditions in the Gulf of Mexico during the DWHS without additional information on



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the chemical composition (aliphatics, aromatics) and particle size distribution within the mesocosms over time.

c) High Oil and Dispersant Exposures in a Closed Artificial System

The static closed artificial experimental system appeared to have limited applicability to the Gulf of Mexico, where currents and tides cause extensive water exchange. Natural sunlight was reported to be largely excluded from the exposures, which would reduce environmentally relevant photodegradation of oil and dispersant. The ecological relevance of the dispersant applications to the tested near shore microbial community is uncertain. Federal law prohibits dispersant application within 3 miles of shoreline, and no dispersant applications were performed near shore during the DWHS. Of additional concern, the oil exposures appeared to very high relative to the size of the mesocosm exposures.

d) Unclear or Inadequate Sampling and Analytical Procedures

Many of the sampling and analytical procedures were either unclear because of insufficient detail or appeared to be inadequate because of sampling concerns or inconsistencies in the results. For example, it was unclear where samples were collected within the mesocosm, which is a concern because of the can apparent heterogeneous distribution of oil. Also in addition, the FlowCAM results did not appear to be consistent with the stated larger droplet size formation from recoalescence over time. The volumes collected for zooplankton (e.g., ciliate predators) abundance appeared to be too low to allow quantitation, thus conclusions regarding inhibition of ciliates and speculation on the effects of zooplankton abundance appear unfounded. Other areas of concern included the uncertain influence of dispersant and oil on flow cytometry counts of microbes, and inadequate oil and dispersant characterization.