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The Effect of Oil Pollution on Marine Microbial Populations in Israeli Coastal Waters

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Abstract : The high demand for oil and its by-products is symptomatic of the 21st century and occasionally leads to oil spills and pollution of coastal waters. Marine oil pollution may originate from a variety of sources -urban runoff, tanker cleaning, drilling activities, and oil spills. These events may release large amounts of highly toxic polycyclic aromatic hydrocarbons (PAHs) and other pollutants to coastal water, thereby threatening local marine life. Here, we investigated the effects of crude oil on the temporal dynamics of phytoplankton and heterotrophic bacteria in Israeli coastal waters. To this end, we added crude oil (500 µm thick layer, with and without additional nutrients; NO_3 and PO_4) to mesocosms ($1m^3$ bags) containing oligotrophic surface coastal water collected near Haifa during summer and winter. Changes in phytoplankton biomass, activity and diversity were monitored daily for 5-6 days. Our results demonstrate that crude oil addition resulted in a pronounced decrease in phytoplankton biomass and production rates, while heterotrophic bacterial production increased significantly. Importantly, a few days post addition we found that the oil-degrading bacteria, Oleibacter sp. and Oleispira sp. appeared in the mesocosms and that the addition of nutrients (along with the crude oil) further increased this trend. This suggests that oil-degrading bacteria may be NO_3 and PO_4 limited in Israeli coastal waters. The results of this study should enable us to establish improved science-based environmental policy with respect to handling crude oil pollution in this region.

Keywords : heterotrophic bacteria, nutrients, mesocosm, oil pollution, oligotrophic, phytoplankton
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