

Simulating The Biological Effect of Oil Spills in Tokyo Bay by Using A Coupled Oil Spill - Toxicity Model

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Abstract

A three-dimensional oil fate/transport model combined with an oil toxicity model to simulate the biological effects due to an oil spill is described. Specifically, the focus of this paper is on the effect on fish. However, the model formulation can be extended to determine the effects on other species. The model can simulate oil releases from the water surface or from an underwater source. The output from the oil transport and fate model along with the oil toxicity data are used by the oil toxicity sub-model to determine the biological effect. The mortality of a fish kind is estimated by using the Additive Toxicity method.

From an economical point of view, Tokyo Bay is the most important bay in Japan. There are six ports in Tokyo Bay: Tokyo, Yokohama, Kawasaki, Yokosuka, Chiba, and Kisarazu. It is also a good fishing ground for pelagic fish and benthic shellfish. In this paper, seven scenarios are simulated which use real biological data in Tokyo Bay. These simulations investigate the difference in mortality of different species, as well as the mortalities for nighttime vs. daytime spills and a surface spill vs. an underwater spill. The simulations are the worst-case scenarios during a fishing season.