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Acute and Chronic Effects of Crude and Dispersed Oil on Pre-Smolt Stage of Chinook Salmon

Due to the large maritime transport of crude oil from Alaska to San Francisco Bay, there is significant potential for an oil spill in the bay that could seriously impact salmon populations during key periods of their migration, particularly when pre-smolts of salmon are in the bay from the Sacramento River. Our current OWCN study is demonstrating the acute metabolic effects in salmon smolts exposed to crude oil at sublethal levels. As an earlier life stage, pre-smolts may possibly be more susceptible than smolts and thus under high risk of oil exposure from the large tanker traffic in San Francisco Bay. Therefore, this project will compare the toxic actions of the water-accommodated fraction (WAF) and chemically dispersed fraction (a chemically enhanced water-accommodated fraction; CEWAF) of Prudhoe Bay Crude Oil (PBCO) to pre-smolts of Chinook salmon (Oncorhynchus tshawytscha). The hypothesis to be tested is: *The toxic impacts of crude oil on pre-smolts of Chinook salmon are increased by application of chemical dispersants.*

The specific aims are:

1. **Year 1**: To conduct field-modeled laboratory exposures of pre-smolt salmon with declining concentrations of the WAF and CEWAF of PBCO, with the goal of determining the concentrations that induce metabolic stress, narcosis, and mortality; stress will be assessed using NMR-based metabolomics.

2. **Year 2**: To complete the Year 1 experiments, and to determine the long-term growth and metabolic viability of the acutely exposed fish by their extended culturing in clean (oil- and dispersant-free) water at a salinity representative of San Francisco Bay.

This project is designed to proceed as a two-year study. During Year 1, a closed, flow-through test system for exposing pre-smolts of salmon to declining WAF or CEWAF (using Corexit 9500) of PBCO will be applied to study toxic impact of pre-smolts including: metabolic stress, narcosis, and mortality; metabolic stress will be assessed using an advanced NMR metabolomic approach. During Year 2, surviving fish from the previous exposures will be cultured in clean water at a salinity representative of San Francisco Bay to determine effects of the short-term exposures on long-term growth and viability. Remaining metabolomic analyses of fish tissues will be completed during Year 2. This study will determine the acute actions of the bioavailable fractions of oil on pre-smolts of salmon using both lethal and sublethal endpoints in environmentally-relevant exposure conditions. The results will provide information on the relative risk of oil or chemically-dispersed oil to migrating salmon, allowing for more informed decision-making in the event of a coastal spill.