

Executive Summary

We propose a study of the anomalous low phytoplankton productivity in Suisun Bay by comparing Suisun Bay phytoplankton growth and nutrient uptake rates with those in Central San Francisco Bay, the Delta and the Sacramento and San Joaquin Rivers and using mesocosms to evaluate causal drivers. Recent declines in pelagic fishes in the upper SF Estuary (the Delta and Suisun Bay) and the need to understand the underlying causes resulted in the formation of a Pelagic Organism Decline (POD) project work team by the Interagency Ecological Program. One of their explanations was the Bad Suisun Bay Hypothesis which focuses on food web effects in Suisun Bay and the western Delta, and is directly addressed by this proposal. As such the research considers a priority research area for CALFED Science Program, the POD. More specific to this solicitation, we address Priority Topic 4: Habitat Availability and Response to Change and all the associated questions, by proposing to learn more about the quality of the Delta habitat for key species, the "bad" drivers that are responsible and using modeling to assess how change will affect habitat conditions at the food web level. Our studies have shown that conditions in Suisun Bay are far less favorable for phytoplankton than in San Pablo and Central Bays, with reduced nutrient uptake capacity and growth rates that results in low primary production and chlorophyll accumulation. Other stressors (e.g. Corbula grazing) will modulate the chlorophyll biomass. The combination of low biomass and growth rates results in much reduced production of quality phytoplankton food for higher trophic levels. We have used experimental mesocosms to test how SFE water (without resident phytoplankton) influences the growth of a phytoplankton inoculum and observed that they do not grow in Suisun Bay water whereas they will in Central and San Pablo Bay water. These observations support the idea that there is something "bad" about the water in Suisun Bay and led us to ask 1) is the "bad" habitat for phytoplankton in Suisun Bay an anomalous condition or part of a continuum between freshwater and oceanic systems? 2) what drivers contribute to the low growth rates in Suisun Bay and how well can the phytoplankton recover when these are removed or changed? 3) if Suisun and Delta phytoplankton are encouraged to grow in near natural conditions, which phytoplankton members of the community respond? What is the underlying physiological mechanism? and 4) Can a management approach be identified from the answers to alleviate the diminished food sources linked to the POD? Our simple conceptual model for the Suisun habitat uses phytoplankton to signal the "bad" conditions. Our hypothesis is that Suisun is an anomalous estuarine habitat in which inhibitory effects on physiology result in little chlorophyll of poor food quality for the Delta food web. Removal of the "bad" factors should switch the growth and community structure towards the better quality phytoplankton that occurs in Central Bay. The scope of work includes an administrative task, a fieldwork based task to describe the "bad" Suisun habitat in context of upstream and downstream, an experimental task using mesocosms to manipulate possible drivers causing this habitat, a taxonomic task to determine the phytoplankton community structure (food quality) and a modeling task to simulate the effect of change and determine if management practices aimed at this trophic level are feasible. Our expected outcomes are a test of the Bad Suisun Bay Hypothesis and evaluation of possible adaptive management approaches to alleviate the POD.