Executive Summary

The importance of the San Francisco Bay-Delta system to the native juvenile salmonid rearing is poorly understood and existing techniques are unable to address the most important issue, the relationship between fish residence time in the Delta and the Bay to success in later life stages, particularly becoming a successful spawner. In our previous work, we developed geochemical markers in otoliths to characterize the early life history of juvenile Chinook salmon in the Sacramento-San Joaquin river system (Ingram and Weber, 1999; Weber et al., 2002; Weber, 2002; Weber et al., in press). To date, we have developed geochemical tracers for Sacramento River salmon otoliths that (1) distinguish between hatchery-raised and naturally spawned salmon using sulfur isotopes (d34S), (2) determine a fish?s natal river of origin using strontium isotopes (87Sr/86Sr), and (3) can identify the timing of downstream migration from spawning grounds using carbon isotopes (d13C) and (4) of ocean entry using strontium-calcium ratio (Sr/Ca). The missing piece in our work in this river system is a marker or set of markers to determine the timing and duration of use of different parts of the San Francisco Bay-Delta system.

Here, we propose to focus our effort on developing geochemical markers to determine the timing and duration of Delta and Bay use. We will focus on Delta use because the role of the Delta in salmonid rearing is a major question in Central Valley ecosystem and water management, and because we expect the salinity gradient to provide a ready reference for migration from Chipps Island to the Golden Gate. But we will include samples collected between the Delta and the ocean to provide a complete picture of the geochemical markers in the system. To the extent possible, we will identify geochemical markers that identify sub-regions of the Delta.

The otolith geochemical markers that we would establish under CalFed funding would significantly increase our knowledge of the importance of the Delta to salmonid rearing. They would also be applicable to other species that move in and out of the Delta. More broadly, these markers would give us complete geochemical coverage of the system. As a result, we would be able to map the juvenile out-migration of individual spawning chinook salmon from natal watershed to the ocean. This capability would allow us to close the circle on understanding the ultimate importance of differences in outmigration behavior and habitat use. With this full out-migration capability, we would be able to establish a baseline for the importance of Delta and other habitats to successful maturation, and we would be able to examine how salmonid habitat use, particularly in the Delta, is affected by year-to-year environmental variations.