A. Project Summary

Water extraction and exotic species seriously threaten aquatic biodiversity worldwide. Aquatic ecologists have documented the effects of these threats, but are just beginning to evaluate whether their negative impacts can be reversed. Restoration projects present an unparalleled opportunity to assess experimentally the resilience of entire communities and provide a venue for managers and scientists to work together, with managers implementing treatments and scientists objectively evaluating them. Both Fossil Creek, Arizona, and Cuatro Ciénegas, Mexico are important for biodiversity conservation, and both are threatened by flow diversion and invasive species. In these ecosystems, managers have begun – or will soon begin – restoration projects designed to mitigate these threats.

This SGER proposal will capitalize on these projects, and will bring a food-web perspective to assessing their effectiveness. Specifically, SGER funding will support documenting current population densities and distributions, as well as food web structure, before exotic species are chemically removed and flow is restored to Fossil Creek. During the funding period, the initial effects of chemical treatment on native and exotic species will also be assessed. In Cuatro Ciénegas, SGER funding will support a meeting in which a statistically defensible restoration experiment will be designed, taking advantage of this unique 'natural laboratory', with replicate treatment and control pools. This request meets the SGER requirements because it takes advantage of an imminent restoration action. Funding is required immediately in order to characterize the effects of chemical restoration and to collect data before restoration of full flows. Without this funding, it will not be possible to monitor the Fossil Creek restoration program, nor to design a statistically defensible restoration and monitoring program in Cuatro Ciénegas.

The intellectual merits of this proposal include taking a food web approach to conservation and restoration biology. This work sets the stage for testing whether food webs can return to a pristine state following up to a century of disturbance. It takes advantage of large scale restoration projects as ecological experiments and presents a novel use of stable isotopes to establish restoration targets.

The broader impacts include a continuation of the cycle of conservation science already begun in these ecosystems: determining the most severe threats to native species and their food webs, designing appropriate restoration programs, and documenting the effect of these programs on scales that can influence management. My research group will work closely with managers so that our results are incorporated into management decisions.