

## **Project Summary**

### **Rocky Mountains Cooperative Ecosystem Studies Unit**

**Project Title:** Linking whole system carbon cycling to quantitative food webs in the Colorado River, Grand Canyon

**Discipline:** Natural  
**Type of Project:** Research  
**Funding Agency:** USGS  
**Other Partners/Cooperators:** Montana State University  
**Effective Dates:** 2/1/2010 - 6/1/2011  
**Funding Amount:** \$64,066

**Investigators and Agency Representative:**

USGS Contact:

Investigator: Wyatt Cross, Assistant Professor, Department of Ecology, 310 Lewis Hall, Montana State University, Bozeman, MT 59717; (406) 994-2473; wyatt.cross@montana.edu

**Project Abstract:** The Colorado River between Glen Canyon Dam at Lake Powell and Lake Mead is one of the most beautiful, yet hyper-managed freshwater systems in the west. There's no shortage of stakeholders and interest groups that derive resources from the river (e.g., power companies, recreationists, conservation groups), and many of their opinions about how the river (and dam) should be managed are in direct opposition - making this a topical and challenging system to study as an ecologist.

One striking pattern of concern is the recent (last 15-20 years) decline in abundance of some native fishes in the canyon. One example is the Humpback Chub, which only exists in the Colorado River Basin, and has been listed as a federally Endangered Species. Many hypotheses have been put forward as to why these fishes are declining, but one that has not been sufficiently tested is the 'foodbase' hypothesis; That is: is there sufficient production of prey to support healthy populations of native fishes? Is carbon being 'shunted' away from native species by other conspicuous non-native species (e.g., rainbow and brown trout, new zealand mudsnails)?

To get at these questions, we're taking a foodweb-ecosystem approach. By quantifying whole-ecosystem metabolism and secondary production at 6 reaches within the canyon, we will be able to estimate the amount of carbon available for production of invertebrates and fish. Next, using gut content analysis and stable isotopes we'll construct quantitative 'material-flow' food webs for each of our sites. This technique will allow us to measure the amount of available carbon in the system, as well as the pathways and fates of this carbon.

Additionally, we're measuring all inputs, transport and outputs of carbon and nutrients with the goal of constructing whole-canyon elemental budgets. Ultimately, we will apply our work towards developing long-term monitoring protocols to inform the Colorado River adaptive management plan. We also hope our work will be useful for predicting potential ecological changes resulting from future dam operations (e.g., changes to flow and temperature regimes).

**Outcomes with completions dates:** June 1, 2011

**Keywords:** whole-ecosystem, carbon cycling, food webs, Colorado River, Grand Canyon, USGS, Montana State University