

PRELIMINARY DATA SUBJECT TO REVIEW AND REVISION

2010 Biological Modeling Summary

USGS/GCMRC

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The USGS Grand Canyon Monitoring and Research Center has been pursuing some high priority questions for the Adaptive Management Program through the use of models. In the biological arena, GCMRC's senior visiting ecologist Carl Walters recently led two modeling workshops. The first was conducted near one of Dr. Walters' homes, in Cedar Key, Florida in March 2010. The second was conducted in conjunction with a stakeholder workshop for reviewing sediment modeling at Saguaro Lake Ranch, Arizona in April 2010. The Cedar Key workshop was an opportunity for Dr. Walters to work intensively for a week with USGS and cooperating biologists. The resulting models from the Cedar Key workshop were presented over a day and a half to Technical Work Group members and other managers at Saguaro Lake Ranch. What follows is a brief summary of the results of the biological modeling, primarily using the Ecopath/Ecosim platform, provided as a courtesy to the Technical Work Group. This summary was drafted by Dr. Walters, then reviewed with USGS scientists and GCMRC cooperating scientist Richard Valdez. Based on this internal review a **subjective** proportional level of certainty was assigned to the summary statements to provide some **relative quantification** of the level of certainty knowledgeable scientists can be assign to the conclusions at this time. Further data collection and modeling are expected to help increased the certainty in these conclusions, with the eventual goal that they are supported or rejected in peer-reviewed publications.

1. The Little Colorado River is the heart of the native fish community in Grand Canyon. Most humpback chub spawn there (100%), and bluehead sucker (60%) and flannelmouth sucker (60%) also spawn in the LCR. Juvenile native fish leaving the LCR can face severe predation pressure when rainbow trout and brown trout are present in the mainstem Colorado River in the vicinity of the mouth of the LCR (90%). Predation of approximately 4000 humpback chub exceeds estimated effective recruitment of 3500 (80%). Natives may also be disadvantaged by relatively cold water in the mainstem (75%). There is a negative correlation over time between predator abundance and native fish recruitment, beginning in the 1990s as well as after 2003, when warming coincided with mechanical removal.
2. Most of the nonnative fish at the LCR mouth are rainbow trout and brown trout and these two species together have been responsible for the bulk of the predation on humpback chub (90%). Most of the rainbow trout were spawned in the Lees Ferry reach (100%) and most of the brown trout were spawned in Bright Angel Creek (80%).
3. The population of rainbow trout at the mouth of the LCR might be effectively reduced with a removal effort conducted within the first few miles downstream of the Paria River (60%). It may be that the Lees Ferry rainbow trout are behaving like steelhead trout (same species), where the fish leave the reach as juveniles, then swim upstream to spawn as they mature.

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4. The following control measures for rainbow trout might be effective (50%) at reducing predation pressure on humpback chub: removal of downstream migrants (50%), altering ramping rates to disadvantage rainbow trout eggs (30%), altering ramping rates to reduce juvenile recruitment to the adult population (50%).
5. Removing brown trout from Bright Angel Creek would effectively reduce the population of this species and reduce its predation on native fishes (90%).
6. It is not likely (75%) that the LCR can support a much larger population of humpback chub, even if all predators removed because little excess food production is available. Similarly, there is little excess food production in the Lees Ferry reach (75%). Probably 80% of the food base produced in the Lees Ferry reach is consumed, limiting the amount of biomass that will be produced.
7. When numbers of rainbow trout eggs or larvae are reduced in Lees Ferry then survivorship of the remaining individuals increases (i.e., compensatory response) (100%).
8. Sand-mediated backwaters created by high flows do not appear to have any measurable value for humpback chub (100%). These habitats do appear to be beneficial to native sucker species in western Grand Canyon.

Dr. Walters is planning to review these findings, and potentially others, with the Adaptive Management Work Group in August 2010 in Phoenix. Cooperators Ecometric, Inc. (Josh Korman) and Arizona Game and Fish Department anticipate that they can refine the model for the Lees Ferry reach over the coming year. Refinement of a model focused on the LCR reach will be more problematic because fewer data are available there, especially the ages of captured humpback chub, their movements, and origins. Additional data are being collected (or are proposed for collection) that could help better inform these models. GCMRC has allocated a limited amount of funding to continue model development in FY 2011 and FY 2012 (see proposed AMP work plan and budget).