

Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
April 29-30, 2009

Agenda Item

Grand Canyon Monitoring and Research Center (GCMRC) Updates

Action Requested

√ Information item only. We will answer questions but no action is requested.

Presenters

Matthew Andersen, Biological Program Manager, U.S. Geological Survey, GCMRC

Helen Fairley, Cultural Program Manager, U.S. Geological Survey, GCMRC

Paul Grams, Physical Sciences & Modeling, U.S. Geological Survey, GCMRC

John Hamill, Chief, U.S. Geological Survey, GCMRC

Ted Melis, Deputy Chief, U.S. Geological Survey, GCMRC

David Topping, Hydrology And Sediment Scientist, U.S. Geological Survey, GCMRC

Previous Action Taken

N/A

Relevant Science

N/A

Background Information

1. Update on HBC numbers (Andersen)

An estimate of the adult humpback chub population size was previously completed by GCMRC that incorporated capture data through 2006 (Coggins, 2007). Coggins (2007) reviewed how the ASMR model estimates that the Grand Canyon adult humpback chub population declined from an original estimates in 1989 that was likely in excess of 9,000 to a low in 2001 of approximately 5,000 individuals. By 2006 the adult population increased to about 6,000. This agenda item will report on an update of the population size using data through 2008.

Related Background Information:

1. USGS Fact Sheet 2007-1402 was the previous most current peer reviewed estimate of the adult population (Coggins, L.G., Jr., 2007, Abundance trends and status of the Little Colorado River population of humpback chub: an update considering 1989-2006 data: U.S. Geological Survey Open-File Report 2007-1402, 53 p.).
2. Application of the Age-Structured Mark-Recapture model first appeared in the primary scientific literature in 2006 (Coggins, L.G., Jr., Pine, W.E., III, Walters, C.J., van Haverbeke, D.R., Ward, D., Johnstone, H.C., 2006, Abundance trends and status of the Little Colorado River population of humpback chub: North American Journal of Fisheries Management, vol. 26, p. 233-245).

GCMRC contact: Matthew E. Andersen (mandersen@usgs.gov, 928-556-7379)

2. Sediment and 2008 high flow experiment update (Melis, Grams and Topping)

A) Sediment Supply Update – (Topping)

Updates on the mass-balance sand budgets will be presented for the periods leading up to (i.e., October 2006-February 2008), during, and after (i.e., April 2008-March 2009) the 2008 HFE. For the first time, these updates will be provided for 6 reaches: (1) Upper Marble Canyon (0-30 mile), (2) Lower Marble Canyon (30-61 mile), (3) Eastern Grand Canyon (61-87 mile), (4) Central Grand Canyon (87-166 mile), (5) Western Grand Canyon (166-225 mile), (6) Below Diamond Creek and Lake Mead Delta (>225 mile). Below, is the url where the high-resolution sediment-transport data used to construct these sediment budgets can be downloaded:

http://www.gcmrc.gov/products/other_data/gcmrc.aspx

GCMRC contact: David Topping (dtopping@usgs.gov, 928-556-7445)

B) Experimental Update – 2008 High Flow Experiment (HFE) Projects (Grams)

Fine sediment and associated resources

Project 1a: Processing of suspended sediment samples is nearly complete. The project is on schedule for draft report in June or July 2009.

Project 1b: Daily survey data and measurements of flow velocity are processed and being analyzed. The project is on schedule for a draft report between May and July 2009.

Project 1c: Data processing is ongoing and analyses are in progress. The project is on schedule for a draft report in August or September 2009.

Project 1d: Data processing is complete and analysis is set to begin. The project represents the largest new effort of the project 1 components and involves developing new methods for analysis. We believe that the project is still on schedule for a draft or preliminary report in August 2009.

Project 1 - 2008 HFE Sediment Synthesis: USGS cooperater Jack Schmidt of Utah State University is currently compiling historical photographs of selected study sites and comparing those images with photos taken during and following the 2008 high-flow experiment. These photographs will help scientists, managers, and stakeholders evaluate the present condition of sandbars and vegetation relative to the condition prior to the onset of regular monitoring, which began in the early 1990s. These photos are available on the GCMRC website:

(http://www.gcmrc.gov/research/high_flow/2008/science.aspx)

GCMRC contact: Paul Grams (pgrams@usgs.gov, 928-556-7458)

Riparian Vegetation

Project 2: Effect of HFE on native/non-native riparian vegetation: Data processing is essentially complete and analyses are in progress. A poster of some results was presented at the Colorado River Basin Science Symposium in November 2008. Results that were presented showed that plant species richness was similar between vegetated and non-vegetated sites following the HFE. Cover had returned to values recorded in September 2007 for vegetation located above 31,000 cfs at vegetated sites. The most common non-native species encountered was Russian thistle, which requires spring water for germination, possibly supplied by the HFE. Its continued growth is independent of operations. Some of these results were incorporated into a paper submitted to symposium proceedings which is in review. The project is on schedule for a draft report in September 2009. A final report is expected by January 2010.

GCMRC Contact: Barbara Ralston (bralston@usgs.gov, 928-556-7455)

Aquatic Food Web

Project 3: All benthic invertebrate, drift samples, and algal biomass samples collected during the HFE have been processed. Preliminary results from Lees Ferry and LCR flood sampling locations were reported on at the November Science Symposium (Presenter: Rosi-Marshall, CTS1, Title: 'Effects of the 2008 HFE on invertebrates in the Colorado River below Glen Canyon Dam'). Processing and analysis of metabolism and invertebrate growth indicators (RNA) samples collected during the HFE is ongoing. We are on schedule for a comprehensive draft report in September 2009.

GCMRC Contact: Ted Kennedy (tkennedy@usgs.gov, 928 556-7374)

Rainbow Trout Survival and Movement

Project 4a: Evaluation of 2008 High Flow Experiment on Survival Rates for Early Life Stages of Rainbow Trout in the Lees Ferry reach As a extension of the rainbow trout early life stage survival project (RTELSS) in the Lees Ferry reach, which began in the winter of 2003, we evaluated the effects of the March 2008 HFE on survival rates of two annual cohorts of age-0 trout: 1) age-0 fish that were the progeny of adults that spawned primarily between February and April 2007 and that hatched in 2007 (the 2007 cohort); and 2) age-0 fish that were the progeny of 2008 spawners that hatched in 2008 (the 2008 cohort). The effect of the HFE on the 2007 cohort was evaluated by comparing age-0 population estimates immediately before (Feb. 19-21) and after (March 24-25) the HFE. The effect of the HFE on the 2008 cohort was evaluated by comparing the ratio of age-0 abundance in June 2008 to total egg deposition in 2008, as determined by redd counts, with ratios from other years.

There was little effect of the HFE on the abundance of the 2007 cohort of age-0 trout in the Lees Ferry reach. Population estimates for age-0 trout in February 2008 were 16,000 and 15,000 based on catch data from 20 index sites only, and from 20 index sites and first pass catches from mark-recapture experiments (MR), respectively. Population estimates for March were 15,000 (index only) and 17,000 (index + MR). Post-flood estimates were 0.9- and 1.2-fold different than pre-flood estimates for index and index + MR values, respectively. Although we have not yet computed uncertainty in these population estimates, the average coefficient of variation of estimates from other years is approximately 0.3, and it is therefore very unlikely that pre- and post-flood abundance estimates are significantly different. The minimal effect of the HFE in 2008 on the 2007 age-0 cohort differs from what was observed for the 2004 HFE. The age-0 population estimate in December, after the 2004 HFE test, declined by three-fold relative to the estimate determined just before the flood in mid-November, 2004.

Survival of the 2008 age-0 cohort, which hatched and emerged in April through June, 2008, was very high relative to others years of RTELSS sampling (2003, 2004, 2006, 2007). Estimates of the total number of redds deposited in 2007 and 2008 were 1,215 and 2,047, respectively. The age-0 population estimate for June 2008 (546,000) was five-fold higher than the estimate in June 2007 (107,000). Survival between egg deposition and the first few months from emergence, based on the abundance of age-0 fish in June, was more than two-fold higher in 2008 compared to 2007 and previous years. Continuation of sampling in 2009 will provide an additional year for this comparison. Final results will be available by December 2009.

GCMRC Contacts: Matthew E. Andersen (mandersen@usgs.gov, 928-556-7379), Josh Korman (jkorman@ecometric.com, 604-737-8314).

Project 4b: Trout Movement during the HFE. GCMRC presented preliminary results of the trout movement study during the November 2008 Science Symposium. Since the symposium, GCMRC completed and finalized the data analysis with the assistance of our DASA staff. A draft final report was submitted for publication as part of the Science Symposium Proceedings in February. This report is currently being reviewed and is expected to be finalized in June 2009. Abundance indices in combination with acoustic telemetry results indicate that the March 2008 HFE did not cause significant downstream displacement of adult and juvenile rainbow trout in the Lees Ferry. Other evidence suggests that populations of very young trout were not impacted by the March 2008 HFE. However, a three fold decrease in population size of very young trout was observed during the November 2004 HFE. These data suggest the need for further studies to track the fate of very small rainbow trout and other factors which may cause movement during future HFEs.

GCMRC contact: Matthew E. Andersen (mandersen@usgs.gov, 928-556-7379)

Quality of Water Monitoring

Project 5: GCMRC previously presented the preliminary data collected in association with the 2008 HFE to AMWG at the May 2008 meeting. These data remain provisional and will be finalized by 2010.

GCMRC contact: Matthew E. Andersen (mandersen@usgs.gov, 928-556-7379)

Kanab Ambersnail Habitat

Project 6: Kanab ambersnail. One of the terms of the 2008 Biological Opinion required that Kanab ambersnail habitat, primarily cardinal monkeyflower, be moved in advance of the March 2008 experimental high flow. Personnel from AZGFD, USFWS, and BOR participated in conducting this conservation action, moving snail habitat to higher ground for the duration of the high flow. Habitat/vegetation that was moved was replaced following the return to normal dam releases. This vegetation was surveyed again in September 2008. Vegetation had recovered well, becoming reestablished and expanding. Additional surveys to evaluate longer-term condition of this habitat are planned for 2009.

GCMRC contact: Matthew E. Andersen (mandersen@usgs.gov, 928-556-7379)

Synthesis of Experimental High Flow Sediment Research

Project 7: Synthesis of High Flow Sediment Research Findings from 1996 through 2008 (tentatively scheduled for FY2010). Following completion of 2008 High Flow Test sediment reporting by GCMRC staff and cooperating scientists (set for late 2009), the GCMRC intends to pursue development and publication of a comprehensive synthesis on results from the 1996, 2004, and 2008 sediment experiments, task requested by the Glen Canyon Dam Adaptive Management Work Group in 2008. The synthesis report will involve a comprehensive summarization of all previously published results from these three experimental flows, as well as findings from other related sediment research that resulted from tests of Habitat Maintenance Flows in November 1997 and May and September 2000 (as part of the Low Summer Steady Flow experiment). This synthesis activity is contingent upon funding availability as approved in the FY2010 work plan/budget for the GCMRC and would be completed by the end of 2010.

GCMRC contact: Ted Melis (tmelis@usgs.gov; 928-556-7282)

Logistics Activities in Support of 2008 High Flow Experimental Studies

Project 8: During FY2008, the GCMRC provided logistical support for 13 river trips associated with the 2008 High Flow Experiment. Additional support was provided for projects conducting research in the Glen Canyon and Diamond Creek reaches of the Colorado River. All National Park Service Research and Collecting and access (trip) permits were obtained for all HFE projects operating within Grand Canyon National Park and Glen Canyon National Recreation Area. The 2008 preliminary progress report to NPS (electronic entry), required under the terms of the 2008 HFE permit (Principal Investigator: Theodore Melis), was electronically submitted by the PI in the first quarter of 2009.

GCMRC contact: Carol Fritzingler (cfritz@usgs.gov; 928-556-7207)

3. Integrated flow/temperature modeling (Grams)

The team of researchers that is working on the modeling project for 2009-2010 are all currently engaged in the project and are in the process of finalizing a formal project proposal that will be peer reviewed and shared with the TWG this summer. The primary modeling tools that will be worked on are (1) a detailed site-based model to help determine optimal high flow release magnitude and duration, relations between site characteristics and deposition, and near shore temperature dynamics; (2) a bar stability model to help determine the effect of down ramping rates on bar erosion; and (3) larger scale models to help determine the relative effect of alternative operating regimes on sand storage. Many of the questions posed by stakeholders at the 2008 modeling workshop, including the monthly volume-daily regime matrix, are within the scope of the current efforts and will be addressed within the time frame of the two year project. We plan to continue the interaction with AMP stakeholders with a meeting to occur during or around the summer 2009 TWG meeting and again in the fall 2009. The material covered in the summer would include a review and synopsis of the fall 2008 workshop, a presentation of the final modeling project proposal, and opportunity for discussion. The intention for the fall meeting would be to present preliminary findings.

John O'Brien raised three specific questions:

1. Is the analysis (monthly volume-daily regime matrix) possible with current analytical tools, or will additional research/methods need to be developed?
The tools under development in the current project are designed to address these questions. Current tools can do it (like Grams did last fall), but with high uncertainty.
2. Would there be an additional cost to analyze the matrix proposed by John O'Brien? Time for analysis? Would additional funds be necessary to perform this analysis?
This analysis is within the scope of the current project and funding levels – 2-year timeframe with possibility of preliminary results in fall 2009.
3. Do you see utility in this analysis, i.e. is the modeling robust enough to inform us or is the uncertainty too high to be of much use in making predictions?
The analysis will provide managers and stakeholders with an objective tool to help understand the relative impact of different operating scenarios on sand transport. The modeling approach will include assessments of uncertainty. It is likely that some of the scenarios modeled will differ beyond the level of uncertainty and that some will not differ significantly.

GCMRC contact: Paul Grams (pgrams@usgs.gov, 928-556-7458).

4. Status of Resources Fact Sheet (Hamill and Melis)

In October 2005, the US Geological Survey's Grand Canyon Monitoring and Research Center published a comprehensive report on the status and trends of natural, cultural and socioeconomic resources associated with the Glen Canyon Dam Adaptive Management Program (see USGS Circular 1282 by Gloss and others, 2005). The 2005 report included data through 2003. To provide more recent information in 2009, the GCMRC has produced a 4-page, full-color USGS Fact Sheet that provides updates, on the basis of new information published since 2005, including data from 2004 through 2007-08. The new Fact Sheet will be published and available through the USGS web site in April 2009. Copies of this document will be distributed at the April AMWG meeting.

GCMRC contact: Lara Schmit (lschmit@usgs.gov; 928-556-7327)

5. Cultural Resources Monitoring Update (Fairley)

The cultural monitoring R&D project continues to make headway towards development of a pilot monitoring program for cultural resources, despite that fact that GCMRC was unable to get into the field last year to complete planned Phase I work due to unresolved NPS permitting issues. Since the start of FY2009, we have completed several additional reports that are either now published or in process towards being published. We have also compiled and analyzed weather data collected in 2007 and 2008 and caught up on processing a backlog of sand samples. Three posters and one oral presentation about the project were provided at the November 2008 Science Symposium in Tempe, Arizona. Comprehensive updates on all elements of the project were provided to the CRAHG at a meeting in Phoenix on January 6, 2009. Dr. Jack Schmidt from USU is currently working with the project to compile existing GIS data pertaining to the Holocene deposits and geomorphic settings of cultural sites in the CRE, and Dr. Keith Kintigh from ASU is assisting GCMRC in clustering geomorphic and archaeological data for future sampling purposes. Below is a list of publications and presentations that have either been completed and published in FY2009 or are currently undergoing review or final editing prior to final publication. In addition to these products, GCMRC has re-submitted a substantially revised research proposal to Grand Canyon National Park for permitting of field work planned for spring 2009, and project cooperators are in the process of developing several additional reports (e.g., a report on 2008 weather data, an analysis of topographic change in relation to the 2007 weather data, and a synthetic monograph on Phase I results) that we anticipate will be finalized in the latter part of FY2009 and first half of FY2010.

GCMRC contact: Helen Fairley (hfairley@usgs.gov, 928-556-7285)

FY2009 Products and Presentations:

Collins, B.D., Brown, K.B., and Fairley, H., 2008a. Evaluation of Terrestrial LIDAR for Monitoring Geomorphic Change at Archaeological Sites in Grand Canyon National Park, Arizona: U.S. Geological Survey, Open File Report 2008-1384, 60 p. [<http://pubs.usgs.gov/of/2008/1384/>].

Collins, B.D., Kayen, R., Minasian, D., and Fairley, H., 2008b. Terrestrial Lidar Topographic Change Monitoring At Archaeological Sites Along The Colorado River Corridor Of Grand Canyon National Park, Arizona. Oral presentation at *Coming Together: Coordination of Science and Restoration Activities for the Colorado River Ecosystem Conference*, November 19, 2008, Tempe, Arizona.

Collins, B.D., Minasian, D., and Kayen, R., (in press). Topographic Change Detection at Select Archaeological Sites in Grand Canyon National Park, Arizona, 2006-2007: U.S. Geological Survey, Scientific Investigations Report 2009-XXX, 97p.

- Draut, A. E. Andrews, T., Fairley, H. C., and Brown, C. R., (in press), 2007 Weather and Aeolian Sand-Transport Data from the Colorado River Corridor, Grand Canyon, Arizona; U.S. Geological Survey, Open-File Report 2009-XXX.
- Draut, A. E. Hazel, J. E. Jr., Fairley, H. C., and Brown, C. R., 2008, Aeolian Reworking Of Sediment Deposits From The March 2008 Grand Canyon High-Flow Experiment. Poster presented at *Coming Together: Coordination of Science and Restoration Activities for the Colorado River Ecosystem Conference*, November 19, 2008, Tempe, Arizona. (Science Symposium Proceedings article in review.)
- Fairley, H.C. and Sondossi, H., 2008, Applying an Ecosystem Framework to Evaluate Archaeological Site Condition along the Colorado River in Grand Canyon National Park, Arizona. Poster presented at *Coming Together: Coordination of Science and Restoration Activities for the Colorado River Ecosystem Conference*, November 19, 2008, Tempe, Arizona. (Science Symposium Proceedings article in review.)
- Leap, L., n.d., Fiscal Year 2007 Report for Interagency Agreement between National Park Service, Grand Canyon National Park, and the U.S. Geological Survey, Grand Canyon Monitoring and Research Center to Collaborate in the Development of Long-Term Monitoring Protocols for Archaeological Resources of the Colorado River Corridor in Grand Canyon that may be Affected by the Operation of Glen Canyon Dam. Draft report submitted October 3, 2008 to U.S. Geological Survey Grand Canyon Monitoring and Research Center, Flagstaff.
- O'Brien, G. and Pederson, J., 2008, Soil infiltration, shear strength, and gully erosion measured along the Colorado River – what is responsible for the erosion of cultural sites? Poster presented at *Coming Together: Coordination of Science and Restoration Activities for the Colorado River Ecosystem Conference*, November 19, 2008, Tempe, Arizona.
- O'Brien, G. and Pederson, J., n.d. (in review), Geomorphic Attributes Of 232 Cultural Sites Along The Colorado River In Grand Canyon National Park, Arizona. Final draft report dated November 15, 2008 by Department of Geology, Utah State University, Logan, to U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff.
- O'Brien, G. and Pederson, J., n.d. (in review), Gully Erosion Processes and Parameters at Six Cultural Sites Along the Colorado River in Grand Canyon National Park, Arizona. Final draft report dated November 23, 2008, submitted by Department of Geology, Utah State University, Logan, to U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff.