

Grand Canyon Monitoring and Research Center

Fiscal Year 2010 Annual Project Report

for the

Glen Canyon Dam
Adaptive Management Program

December 20, 2010

FISCAL YEAR 2010 PROJECT REPORTS FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

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INTRODUCTION

Following is the Grand Canyon Monitoring and Research Center's (GCMRC) Fiscal Year 2010 Annual Accomplishment Report. This report is prepared primarily for the Technical Work Group (TWG) of the Glen Canyon Dam Adaptive Management Program (GCDAMP). It includes a summary of accomplishments, shortcomings and recommendations related to projects included in GCMRC's FY2010 Work Plan for the GCDAMP. The report is intended to inform the TWG's recommendations related to the development of the FY2012 Work Plan for the GCDAMP.

Complete descriptions of the projects reported in this document can be found in the GCDAMP Biennial Budget and Work Plan --Fiscal Year 2010-11 at the GCMRC website at: [Glen Canyon Dam Adaptive Management Program Biennial Budget and Work Plan - Fiscal Years 2010-2011](#)

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 1.R1.10 Aquatic Food Base	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston, PM	Principal Investigator:	Bob Hall, Emma Rosi-Marshall, Colden Baxter, Theodore Kennedy
E-mail:	bralston@usgs.gov	E-mail	tkennedy@usgs.gov
Telephone:	(928) 556-7455	Telephone:	(928) 556-7374
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP			
<p>The overall goal of this project is to determine the role that food is playing in the distribution, condition, and abundance of fishes throughout the Colorado River ecosystem. Main objectives are to:</p> <ol style="list-style-type: none"> 1) Determine the important energy sources and pathways that support fishes, especially native species and rainbow trout 2) Quantify the abundance of basal resources using a carbon budget framework to determine potential available energy for higher trophic level. 3) Identify composition and quantity of drifting organic matter and invertebrates 4) Incorporate knowledge into bioenergetics model and trophic basis of production calculations 5) Develop core monitoring strategies for the aquatic food base in the Colorado River from Glen Canyon Dam to Diamond Creek 			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>In FY2010 we focused on processing samples, analyzing data, making presentations at AMP and science organization meetings, and writing up results. All of these objectives were met.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Below is a brief summary of recent findings that relate to SSQs.</p> <p>SSQ 1-5. What are the important pathways, and the rate of flux among them, that link lower trophic levels with fish and how will they link to dam operations?</p> <p>Wellard Master's Thesis (see Reports section) provides a comprehensive look at the feeding habits of invertebrates throughout the Colorado River. Invertebrates in Lees Ferry are consuming exclusively algae while invertebrates along downstream reaches are consuming a mix of both algae and tributary-derived detritus. Analysis and synthesis of fish diet data is forthcoming.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
Presentations:			
<ol style="list-style-type: none"> 1) Kennedy, T.A. R.O. Hall, E. Rosi-Marshall, W. Cross, C.V. Baxter. January 18, 2010. "Update of food base research—2009" Annual Reporting Meeting, Glen Canyon Dam Adaptive Management Program, Phoenix, AZ. 2) Kennedy, T.A. R.O. Hall, E. Rosi-Marshall, W. Cross, C.V. Baxter. January 19, 2010. "Food web response to the 2008 controlled flood in Grand Canyon." Annual Reporting Meeting, Glen Canyon Dam Adaptive Management Program, Phoenix, AZ. 3) Kennedy, T.A. R.O. Hall, E. Rosi-Marshall, W. Cross, C.V. Baxter. April 16, 2010. "Update on foodbase research conducted in the Glen Canyon tailwater." Meeting with Lees Ferry fishing guides convened by U.S. Fish and Wildlife Service, Marble Canyon, AZ. 4) Kennedy, T.A. July 28, 2010. "Adaptive Management in Grand Canyon." Outreach/education presentation to Grand Canyon Youth river trip (15 high school aged students from across the U.S.), Flagstaff, AZ. 5) Kennedy, T.A. R.O. Hall, E. Rosi-Marshall, W. Cross, C.V. Baxter. April 14, 2010. "Preliminary findings from the foodbase research project—Glen Canyon tailwater." Ecosystem Modeling Workshop convened by 			

Grand Canyon Monitoring and Research Center, Mesa, AZ.

- 6) Kennedy, T.A. R.O. Hall, E. Rosi-Marshall, W. Cross, C.V. Baxter. April 15, 2010. "Preliminary findings from the foodbase research project—Grand Canyon." Ecosystem Modeling Workshop convened by Grand Canyon Monitoring and Research Center, Mesa, AZ.
- 7) Donner, K. C., C.V. Baxter, S.Z. Seegert, E. Rosi-Marshall, D. Kincaid, T.A. Kennedy, W.F. Cross, R.S. Rogers, R.O. Hall. June 5-11, 2010. "Quality matters: low diversity of high quality food items may amplify potential for competition between native and non-native fishes in a large regulated river." Annual Meeting of the North American Benthological Society, Santa Fe, NM.
- 8) Cross, W.F., C.V. Baxter, K.C. Donner, E.J. Rosi-Marshall, T.A. Kennedy, R.O. Hall, H. Wellard, D. Kincaid. June 5-11, 2010. Energetic food webs help explain unanticipated increase in trout production following the 2008 controlled flood in the Colorado River, Glen Canyon. Annual Meeting of the North American Benthological Society, Santa Fe, NM
- 9) Behn, K.E., T.A. Kennedy, R.O. Hall. June 5-11, 2010. "Fluctuating flows in a large regulated river may reduce production in backwater habitats." Annual Meeting of the North American Benthological Society, Santa Fe, NM.
- 10) Ulseth, A.J., R.O. Hall, T.A. Kennedy. June 5-11, 2010. "Sources of dissolved organic carbon in the Colorado River, Grand Canyon." Annual Meeting of the North American Benthological Society, Santa Fe. NM

Reports/Publications:

- 1) Cross, W.F., E.J. Rosi-Marshall, K.E. Behn, T.A. Kennedy, R.O. Hall, A.E. Fuller, C.V. Baxter, 2010. Invasion and production of New Zealand mud snails in the Colorado River, Glen Canyon. *Biological Invasions* DOI 10.1007/s10530-010-9694-y
- 2) Rosi-Marshall, E.J., T.A. Kennedy, Kincaid, D.W., Cross, W.F., Kelly, H.A.W., Behn, K.A., White, T., Hall, R.O., Jr., and Baxter, C.V., 2010, Short-term effects of the 2008 high-flow experiment on macroinvertebrates in the Colorado River below Glen Canyon Dam, Arizona: U.S. Geological Survey Open-File Report 2010-1031, 28 p. [<http://pubs.usgs.gov/of/2010/1031/>]
- 3) Behn, K.E., T.A. Kennedy, and R.O. Hall, 2010. Basal resources in backwaters of the Colorado River below Glen Canyon Dam—effects of discharge regimes and comparison with mainstem depositional environments: U.S. Geological Survey Open-File Report 2010-1075, 25 p. [<http://pubs.usgs.gov/of/2010/1075/>]
- 4) Hall, R.O., T.A. Kennedy, E.J. Rosi-Marshall, W.F. Cross, H.A. Wellard, C.V. Baxter, 2010. Aquatic production and carbon flow in the Colorado River Pages 105-112 in Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona. Eds T.S. Melis, J.F. Hamill, L.G. Coggins, P.E. Grams, T.A. Kennedy, D.M. Kubly, and B.E. Ralston U.S. Geological Survey Scientific Investigations Report 2010–5135. [<http://pubs.usgs.gov/sir/2010/5135/>]
- 5) Kennedy, T.A. and B. Ralston, 2010. Regulation leads to increases in riparian vegetation, but not direct allochthonous inputs, along the Colorado River in Grand Canyon, Arizona. *River Research and Applications* DOI: 10.1002/rra.1431 (published early online)
- 6) Wellard-Kelly, HA, 2010, Resource composition and macroinvertebrate resource consumption in the Colorado River below Glen Canyon Dam, Master's Thesis, Loyola University, Chicago.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

- Carbon budget for the Colorado River (delivery date unknown)
- Invertebrate production for 5 sites in Grand Canyon (delivery date unknown)
- Assessing the potential for food limitation of native fishes in Grand Canyon (delivery date unknown)
- Invertebrate diets reflect downstream and seasonal changes in resource availability (delivery date **unknown**)

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

GCMRC believes the overall approach taken by the foodbase project has strong merit and that this project has been making adequate progress. However, the AMWG recommendation to reduce project funding in FY11 suggests they do not agree with this assessment. External review of the foodbase project in the form of a Protocol Evaluation Panel will hopefully resolve these differences; a foodbase PEP is planned for summer 2011.

(9.) FY2010 BUDGET REPORT

FINANCIAL INFORMATION COLLECTION DATE:

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FY10 PLANNED GROSS BUDGET:	\$500,147		FISCAL YEAR NET AVAIL BAL:		\$ 4 4 5 , 1 2 2
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:					\$523,319
END OF FISCAL YEAR AVAILABLE BALANCE:					<\$23,173>
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Due to funding reductions in FY2011 we cancelled river trips, scaled back field sampling at Lees Ferry and Diamond Creek from monthly to quarterly, reduced technician support from 4 to 1.5, and eliminated funding for the Cooperative Agreement with the University of Wyoming. These cut backs may affect our ability to meet project objectives in a timely manner.					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DA TE:	1 2 / 0 8 / 2 0 1 0
SIGNATURE: (Must be signed or submitted by PM.)		TITLE:	Principal Investigator	DA TE:	1 2 / 0 8 / 2 0 1 0

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 1.R4.10 Impacts of Various Flow Regimes on the Aquatic Food Base	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Theodore Kennedy
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Telephone:	(928) 556-7455	Telephone:	(928) 556-7374
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The food base project (BIO 1.R1.08) is constructing quantitative food webs for the Colorado River that will determine the extent to which fishes are food limited. However, the response of benthic and drifting food resources to various flow management regimes remains uncertain.</p> <p>The goal of this project is to determine whether flow management regimes affect benthic and drifting food resources. Major objectives include:</p> <ol style="list-style-type: none"> 1. Determining whether flow regime influences concentrations/loadings of drifting algae and invertebrates 2. Determining whether flow regime influences production/standing stock of benthic algae and invertebrates 			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>All invertebrate drift data (400 samples) are now in an ACCESS database at GCMRC. Analysis and synthesis of these data is ongoing. Bob Hall (Univ. of Wyoming) and Kennedy are now collaborating with Rob Payne (Montana State University) to continue development of a model for estimating algae production in Lees Ferry using dissolved oxygen data.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>Below is a brief summary of recent findings that relate to SSQs. These findings are unpublished at this time.</p> <p>SSQ 1-6. Are trends in the abundance of fish populations, or indicators from fish such as growth, condition, and body composition (for example, lipids), correlated with patterns in invertebrate flux?</p> <p>Trends in rainbow trout populations appear to be correlated to invertebrate flux. Rainbow trout populations in Lees Ferry increased following the 2008 artificial flood. Invertebrate drift rates increased by roughly 100% after the 2008 artificial flood. Invertebrate drift rates were corroborated by trends in invertebrate production. Midges and black flies drove increases in drift rates and the annual production of both of these species increased after the 2008 artificial flood. Thus, the artificial flood increased invertebrate flux and this led to increases in rainbow trout populations due to higher rainbow trout juvenile growth and survival.</p> <p>SSQ 3-5. How is invertebrate flux affected by water quality (for example, temperature, nutrient concentrations, turbidity) and dam operations?</p> <p>Invertebrate flux (drift) appears to be affected by invertebrate biomass and also dam operations. Invertebrate biomass in Lees Ferry varies over 10-fold annually and there is a strong correlation between invertebrate biomass and invertebrate drift rates. Dam operations can also affect invertebrate flux, but the effects appear to be weaker than biomass. The effects of dam operations on invertebrate flux appear to be weak under normal MLFF operations. However, during the 2008 HFE, when discharge changed rapidly and by a large amount, invertebrate flux was strongly and positively correlated with discharge. Flow regime (fluctuating vs. steady) does not appear to have a strong influence on invertebrate flux. These findings come from data collected at Lees Ferry and may not hold for downstream reaches.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<ol style="list-style-type: none"> 1. Kennedy, T.A., W.F. Cross, C.V. Baxter, K. Donner, E.J. Rosi-Marshall, R.O. Hall, K.E Behn, D. Kincaid. June 5-11, 2010. "The use of invertebrate drift in combination with flow food webs to evaluate the effects of a controlled flood on tailwater trout populations." Annual Meeting of the North American Benthological Society, Santa Fe, NM 			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			

Reports planned: Invertebrate drift in a tailwater—effects of flow regime and benthic biomass (delivery data unknown) Algae Production in Lees Ferry—effects of flow regime and benthic biomass (delivery date unknown)			
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>			
Invertebrate drift at Lees Ferry should be included as a core monitoring protocol. We recommend funding Robert Payne (Post-doctoral scientist) for 1 year to allow continued development of the Lees Ferry production model. Additionally, flow experiments might help resolve some uncertainties in the model. Modeling unsteady flow, which is required to make algae production measurements in Lees Ferry, appears to increase the uncertainty/error around those algae production measurements relative to measurements made during steady flow. Short duration (several days), targeted flow experiments might allow us to disentangle the effects of unsteady flow on algae production measurements from the effects that unsteady flow is having on algae production itself.			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$61,694	FISCAL YEAR NET AVAIL BAL:
			\$56,260
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$58,926
END OF FISCAL YEAR AVAILABLE BALANCE:			\$2,768
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>			
Salaries for technicians were underspent due to an oversight by Kennedy.			
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston /s/ Theodore Kennedy	TITLE:	Program Manager
		DATE:	12/08/2010
(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		BIO 2.R1.10 Little Colorado River humpback chub monitoring lower 13.57 km (Population Estimates) (Ongoing)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	David R. Van Haverbeke
E-mail:	bralston@usgs.gov	E-mail	randy_vanhaverbeke@fws.gov
Telephone:	928-556-7455	Telephone:	928-226-1289
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY08 AWP)</i>			
The Grand Canyon Monitoring and Research Center (GCMRC) determined that a rigorous stock assessment program for fishes in the Little Colorado River (LCR) was a priority in 2000. As a result, since 2000, the U.S. Fish and Wildlife Service have been contracted by GCMRC to conduct mark-recapture and monitoring activities in the lower 13.57 km of the LCR. The primary objective has been to monitor for annual changes in the spring and fall population abundances of humpback chub ≥ 150 mm, and ≥ 200 mm in the LCR. In spring 2009 researchers began PIT tagging humpback chub down to 100 mm, thus allowing estimates for this smaller size class to be generated. This protocol was continued in 2010. Also, in fall 2009 (and in cooperation with the Nearshore Ecology (NSE) Project), researchers implanted Visible Elastomer (VIE) tags in humpback chub <100 mm in the Boulders reach (~0-5 km) in order to obtain capture probability information and a population estimate for this size class of fish. This protocol was also continued in fall 2010, however, VIE tagging was extended to include all three reaches in the lower 13.57 m of the LCR. Data from all of the above efforts are also used to generate and update the Age Structured Mark-Recapture (ASMR) model developed at GCMRC by Lew Coggins. Finally, these trips provide opportunities to characterize the natural history and ecology of the LCR fish community.			
(4.) REPORT ON FY10 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY08 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
During 2010, two mark-recapture efforts were successfully conducted in the LCR. The purpose of these efforts was to conduct closed Chapman Peterson mark-recapture estimates of the spring and fall abundances of humpback chub (<i>Gila cypha</i>) in the lower 13.57 km of the LCR; as well as to conduct routine monitoring of other native and non-native species of fish. Trip dates for the spring mark-recapture effort were 12-19 May ("marking" trip), and 1-10 June ("recapture" trip). Trip dates for the fall mark-recapture effort were 15-23 September ("marking" trip), and 12-21 October ("recapture" trip). During the spring trips, a total of 1,080 hoop net sets were deployed, yielding 25,242 hours of fishing effort. A total of 9,402 fish were captured, of which 3,264 were humpback chub. Preliminary mark-recapture results estimate that there were 8,908 (SE = 534) humpback chub ≥ 100 mm in the lower 13.57 km of the			

LCR during the spring of 2010. Of these fish, it was estimated that 8,099 (SE = 522) were ≥ 150 mm, and 6,311 (SE = 480) were ≥ 200 mm. It was also estimated that there were 17,265 (SE = 3,768) bluehead sucker (*Catostomus discobolus*) ≥ 150 mm. During the fall trips, a total of 1,080 hoop net sets were deployed, yielding 25,515 hours of fishing effort. A total of 4,702 fish were captured, of which 2,920 were humpback chub. Preliminary mark-recapture results estimate that there were 3,877 (SE = 258) humpback chub ≥ 100 mm in the lower 13.57 km of the LCR during the fall of 2009. Of these fish, it was estimated that 3,499 (SE = 295) were ≥ 150 mm, and that 2,561 (SE = 220) were ≥ 200 mm. It was also estimated that there were 6,882 (SE = 926) humpback chub < 100 mm based on the VIE fall mark-recapture effort.

The spring and fall mark-recapture efforts in the lower 13.57 km of the LCR, and carried out since fall of 2000, have consistently provided researchers with bi-annual closed population estimates of humpback chub ≥ 150 mm in the LCR, as well as adult humpback chub ≥ 200 mm. Humpback chub population numbers were relative stability from 2000-2006, with significant increases in abundance from 2007-2010. Data from both the spring and fall LCR trips have been important in generating and updating the ASMR model at GCMRC.

Performing bi-annual closed Chapman Peterson estimates in the LCR provides researchers with an independent check of trend in the open ASMR model. Importantly, both methods have shown comparative uniformity in major trend results. Furthermore, the closed population estimates provide researchers with a more intimate grasp of population dynamics specifically within the LCR, the river that is key for survival of the species. This is opposed to the ASMR which provides researchers with a broader picture inclusive of the LCR and of the mainstem Colorado River (i.e., the LCR "aggregation").

(5.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

- Spring 2010 Monitoring of Humpback Chub (*Gila cypha*) and other Fishes in the Lower 13.57 km of the Little Colorado River, Arizona. Trip Report: Little Colorado River 12-19 May 2010 and 1-10 June, 2010. Prepared for U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. Michael J. Pillow, U.S. Fish and Wildlife Service, Arizona National Fish and Wildlife Conservation Office, Flagstaff, Arizona. August 2010. Interagency Acquisition No. 01-3022-R1009 (Task 1), Document No. USFWS-AZFWCO-FL-10-004. 21 pp.
- Data for the spring 2010 mark-recapture trips are archived at the Grand Canyon Monitoring and Research Center in six MS Access files entitled: LC20100512_Boulders.mdb, LC20100512_Coyote.mdb, LC20100512_Salt.mdb, LC20100601_Boulders.mdb, LC20100601_Coyote.mdb, and LC20100601_Salt.mdb.
- Fall 2010 Monitoring of Humpback Chub (*Gila cypha*) and other Fishes in the Lower 13.57 km of the Little Colorado River, Arizona. Trip Report: Little Colorado River September 15-23 and October 12-21, 2010. Prepared for U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. Dennis M. Stone, U.S. Fish and Wildlife Service, Arizona Fish and Wildlife Conservation Office, Flagstaff, Arizona, November 2010. Interagency Acquisition No. 01-3022-R1009 (Task 1); Document No. USFWS-AZFWCO-FL-11-001. 13 pp.
- Data for the fall 2010 LCR mark-recapture trips are archived at the Grand Canyon Monitoring and Research Center in six MS Access files entitled: LC20100915_Boulders.mdb, LC20100915_Coyote.mdb, LC20100915_Salt.mdb, LC20101012_Boulders.mdb, LC20101012_Coyote.mdb, and LC20101012_Salt.mdb.
- Mark-Recapture Studies of the Humpback Chub in the Little Colorado River, Grand Canyon, AZ. David R. Van Haverbeke, U.S. Fish and Wildlife Service. Poster presentation delivered at Desert Fishes Council, Moab, Utah, November, 2010.
- Van Haverbeke, D.R. 2010. The Humpback Chub of Grand Canyon. Pp. 261-268 *In* Melis, T.S., Hamill, J.F., Coggins, L.G. Jr., Bennett, G.E, Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, BE. eds. 2010, Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 372 p.
- Stone, Dennis, M. 2010. Overriding effects of species-specific turbidity thresholds on hoop-net catch rates of native fishes in the Little Colorado River, Arizona. *Trans. Am. Fish. Soc.* 139:1150-1170.

(6.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

1. 2010 Mark-Recapture and Fish Monitoring Activities in the Little Colorado River in Grand Canyon During 2010. Open File Report expected draft delivery date to GCMRC on 31 January 2010.
2. Closed Population Estimates of Humpback Chub (*Gila cypha*) in the Little Colorado River, Grand Canyon. By David R. Van Haverbeke. Presentation expected to be delivered at the 2010 Colorado River Annual Biologist Meeting, Laughlin NV. January 2010.
3. Closed Population Estimates of Humpback Chub (*Gila cypha*) in the Little Colorado River, Grand Canyon. By David R. Van Haverbeke. Presentation expected to be delivered at the Arizona/New Mexico Chapter of the American Fisheries Society. February 2010.

(7.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or*

activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)

It is recommended that the annual efforts to monitor the spring and fall abundances of humpback chub in the Little Colorado River are continued. Both the spring and the fall efforts provide researchers with an understanding of the annual ebb and flow dynamics of humpback chub abundance in the LCR, as well as providing a comparison with the LCR aggregation as a whole (as portrayed by the ASMR). Our spring efforts are timed to coincide with the peak of humpback chub spawning within the LCR and therefore provide GCMRC with a reliable measure of the annual spawning magnitude. Our fall estimate is aimed at providing an estimate of the fall abundance of humpback chub in the LCR. In addition, the fall mark-recapture effort provides important data to ASMR. Finally, because VIE mark-recapture methods have been added to the fall mark-recapture efforts, this provides managers with an estimate of the number of age-0 humpback chub in the LCR that may be available for 1) recruitment into the main LCR population, or 2) translocation activities to other tributaries. This has become especially important to establish responsible guidelines to avoid "over-cropping" of age-0 humpback chub to be harvested for several translocation projects that are ongoing or being planned. These include: 1) Chute Falls Translocations, 2) establishing an emergency refuge population of humpback chub at Dexter National Fish Hatchery and Technology Center, 3) Shinumo Creek translocations, and 4) planned translocations of humpback chub into Havasu Creek. Finally, information gleaned on the abundances of age-0 humpback chub is expected to assist managers in making decisions concerning future High Flow Events in Grand Canyon.

(8.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY PLANNED GROSS BUDGET:		\$453,889	FISCAL YEAR NET AVAIL BAL:		\$419,455
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:					\$453,889
END OF FISCAL YEAR AVAILABLE BALANCE:					\$0
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ David R. Van Haverbeke	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		BIO 2.R2.10 Little Colorado River Humpback Chub Monitoring, Lower 1,200m (Ongoing)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Brian C. Clark, Arizona Game and Fish Department
E-mail:	bralston@usgs.gov	E-mail	bclark@azgfd.gov
Telephone:	(928) 556-7455	Telephone:	(928) 226-7677
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The overall goal of this project is to provide an overall assessment for humpback chub in the Little Colorado River and the specific objectives include: providing other pertinent information related to physical parameters of the LCR (that is, temperature and turbidity), length frequency data, community composition, sexual condition and characteristics of native fish (gender, ripe, tuberculate, etc.), frequency of external parasites (that is, primarily <i>Lernaea cyprinacea</i>), and predation; and collecting ancillary data to support the stock assessment models (for example, mark-recapture tagging data, length-frequency data). The data collected is utilized to annually assess relative abundance (catch per unit effort [CPUE]) of all size classes of humpback chub, bluehead sucker, flannelmouth sucker, speckled dace and all nonnative species encountered. This project was established by the Arizona Game and Fish Department (AZGFD) in 1987 and has operated continuously through 2010, with the exception of 2000–01. The lower 1,200 meter project is the longest standardized relative abundance dataset available for comparison as an independent validation for mark-recapture population models for humpback chub.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Sampling in the lower 1,200 meters of the Little Colorado River took place from May 13 through June 9, 2010 with a few exceptions. The lower 1,200 m annual monitoring was originally slated to begin in April. Due to unusually high flows associated with spring snow run-off (~1,500 cfs), monitoring activities were postponed for approximately three weeks to ensure crew safety and proper gear deployment. Nets were not deployed from May 20-24, due to helicopter support weather concerns (windy conditions). Thirteen hoop nets were deployed in standardized locations and checked once daily when crew members were in the field. All species encountered were handled according to existing protocols. Native species dominated the catch comprising ~98% of the total catch. Catch per unit effort trends for bluehead and flannelmouth sucker continue to remain at levels that are greater than historical records. Catch per unit effort trends of humpback chub ≥ 200 mm continued to remain similar to trends observed during 1989-90.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>SSQ 1-1. To what extent are adult populations of native fish controlled by production of young fish from tributaries, spawning and incubation in the mainstem, survival of YoY and juvenile stages in the mainstem, or by changes in growth and maturation in the adult population as influenced by mainstem conditions?</p> <p>SSQ 1-2. Does a decrease in the abundance of rainbow trout and other cold- and warm water nonnatives in Marble and eastern Grand Canyons result in an improvement in the recruitment rate of juvenile HBC to the adult population?</p> <p>Catch rate trends for humpback chub < 150 mm have declined since 2008, but remain at levels similar to the early 1990's monitoring period. Catch rates for humpback chub 151-280 mm have increased since 2007 and continue to be statistically similar during the last three years. Catch rates for humpback chub > 200 mm have also increased since 2007 and remain statistically similar during the last three years.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
Published manuscripts:			
<p>Clark, B.C., Persons, W.S., and Ward, D.L., 2010, Little Colorado River lower 1,200-meter long-term fish monitoring, 1987–2008, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., 2010, Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific</p>			

Submitted reports in 2010:

-Clark, B. C. 2010. 2010 Little Colorado River Lower 1200 meter Fish Monitoring Trip Report (LC20100513). Trip Report submitted to the Grand Canyon Monitoring and Research Center, Flagstaff, AZ. Arizona Game and Fish Department, Phoenix, AZ. Cooperative Agreement No. G09AC00036. 10 pp.

Presentations in 2010:

Oral

- Fish monitoring in the Little Colorado River 1987-2008. Colorado River Aquatic Biologists meeting, Laughlin, NV, Jan. 9-10, 2010.

Poster

-Status and Trends in the Lower 1200 meters of the Little Colorado River Fish Community in Grand Canyon 1987-2009. AFS/TWS meeting, Flagstaff, AZ. Feb.2010.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Little Colorado River Lower 1200 meter Hoop Net Monitoring 2010 Annual Report. Expected delivery: December 2010.

2010 Continuous Underwater PIT tag Scanner (CUPS) monitoring in the Little Colorado River. Expected delivery: January 2010.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Lower 1200 m Little Colorado River monitoring was reviewed by a Protocol Evaluation Panel in 2009. Work in the lower 1200 m has supported experimentation with remote Passive Integrated Transponder (PIT) tag readers. Continuation of the pilot project for remote detection of PIT tagged fishes is recommended. The continuous underwater PIT tag scanner (CUPS) project is in the 7th year of operation. This method of detecting fishes implanted with PIT tags allows researchers to gather information without handling the fish, therefore reducing biological and physiological stress related responses. This noninvasive method has the potential to provide some insight into capture efficiency of standardized hoop nets, seasonal spawning movement and possibly other life history components (i.e., habitat use of resident fishes).

The PIT tagging of humpback chub > 100 mm began in 2009. The CUPS antenna arrays and the MUX antennae array (installed in the summer of 2009) have the potential of increasing recapture rates of fishes that are historically not susceptible to current monitoring gear (i.e. adult common carp). Currently, little is known about the survival rate of HBC less than 150 mm. The CUPS and MUX antennas would serve as potential methods of detecting juvenile humpback chub during periods when annual monitoring is not conducted.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY PLANNED GROSS BUDGET:	\$57,215	FISCAL YEAR NET AVAIL BAL: \$53,000
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:		\$57,215
END OF FISCAL YEAR AVAILABLE BALANCE:		\$0

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/09/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Brian C. Clark	TITLE:	Principal Investigator	DATE:	12/09/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY08 Annual Work Plan)</i>		BIO 2.M3.10 Humpback Chub Translocation and Monitoring Above Chute Falls	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	David R. Van Haverbeke
E-mail:	bralston@usgs.gov	E-mail	randy_vanhaverbeke@fws.gov
Telephone:		Telephone:	928-226-1289
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY08 AWP)</i>			
<p>In December 2002 (and during Section 7 re-initiation in March 2003), a conservation action was identified by the U.S Bureau of Reclamation, the Grand Canyon Monitoring and Research Center (GCMRC) and the National Park Service to translocate 300 (50 to 100 mm) humpback chub (<i>Gila cypha</i>) from the lower reaches the Little Colorado River (LCR) to an upriver area of the LCR (16.1 km) above a travertine structure known as Chute Falls. This was intended as a voluntary conservation action to offset the potential impacts on humpback chub from experimental releases from Glen Canyon Dam and mechanical removal of nonnative fish. This initial action was followed by translocation of another 300 humpback chub (50-100 mm) in July 2004, another 567 (50-100 mm) in July 2005, another 299 (86-136 mm) in 2008, another 194 (85-131 mm) in 2009, and another 109 in 2010. The primary objective of the translocations (as stated in the Biological Opinion) is a conservation action to attempt to diminish the loss of humpback chub in the 50 to 100 mm size class.</p> <p>Additionally, in summer 2006 a mark-recapture effort was initiated in the LCR (between 13.57 and 18.1 km) in order to track the translocated humpback chub. This mark-recapture effort was conducted again in the summers of 2007, 2008, and 2009. In 2010, unusual prolonged spring flooding occurred in the LCR. This flooding directly or indirectly resulted in displacement or movement downriver of nearly all humpback chub in the 13.57 to 18.1 reach of river. Because of this, in 2010 only one monitoring trip was conducted during 1-10 June (i.e., it was not considered prudent to conduct a subsequent recapture trip in lieu of almost no fish being present). The purposes of these annual mark-recapture efforts are to: 1) track the abundance of translocated humpback chub above Chute Falls (14.1 to 18.1 km), and 2) to estimate the abundance of humpback chub in a small stretch of the LCR between 13.57 and 14.1 km. This small stretch of the LCR is of importance because it is where translocated humpback are generally detected if they vacate (i.e., move downriver) from above Chute Falls. In addition, this small stretch of the LCR is logistically impractical to sample during our primary LCR mark-recapture efforts conducted between 0 and 13.57 km. Thus, in addition to tracking the abundance of translocated humpback chub, the Chute Falls mark-recapture efforts compliment the primary mark-recapture efforts in the LCR. Finally, the data collected during these mark-recapture efforts are used in the open Age Structured Mark Recapture model developed by Lew Coggins at GCMRC.</p>			
(4.) REPORT ON FY10 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY10 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Between 12 to 14 July 2010, 109 humpback chub (81 to 130 mm) were captured in the LCR between 0.9 and 3.3 km. These fish were transported by helicopter to 16.2 km in the LCR on 15 July and released alive on 16 July 2010. Mean total length (TL) of the humpback chub during the 2010 translocation was 113 mm. Mean TLs of translocated fish during the 2003, 2004, 2005, 2008 and 2009 efforts were 62, 69, 79, 117 and 118 mm, respectively. Collecting a larger size class between 2008 and 2010 was done to safely accommodate PIT tagging of the translocated fish (i.e., translocated humpback chub between 2003 and 2005 were not PIT tagged, but were implanted with Visible Elastomer tags, which made tracking their abundances over time difficult).</p> <p>Also during summer of 2010, a mark-recapture effort was attempted in the LCR between 13.57 and 18.1 km. As mentioned above, lack of humpback chub captures during the 1-10 June "marking" trip dictated that a subsequent "recapture" trip was cancelled. However, during the 1-10 June trip, a total of 170 hoop net sets were deployed, yielding 3,927 hours of fishing effort. A total of 1,888 fish were captured, of which only 13 were humpback chub, and 1,857 were speckled dace (<i>Rhinichthys osculus</i>).</p> <p>USFWS has demonstrated that humpback chub can successfully be translocated to above Chute Falls. This will assist with other planned translocation efforts in Grand Canyon as they occur. Our efforts have shown that humpback chub translocated to above Chute Falls typically have high growth rates, can have high 1-year survivorship (up to 89%), and that many individuals eventually migrate into the lower sections of the LCR (0-14.1 km). Humpback chub can ascend or circumvent Chute Falls (as indicated by the captures five adult humpback chub that have migrated above Chute Falls), and humpback chub may successfully spawn and offspring survive above Chute Falls (as suggested by the captures of three non-translocated age-0 humpback chub found above Chute Falls in 2007).</p>			
(5.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			

- 1) June 2010 Monitoring of Humpback Chub (*Gila cypha*) and other fishes above Lower Atomizer Falls in the Little Colorado River, Arizona: Trip Report for the June 1-10, 2010 Monitoring Trip and July 12-16, 2010 Translocation Trip in the Little Colorado River, Arizona. Prepared for U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. Dennis Stone, U.S. Fish and Wildlife Service, Arizona Fish and Wildlife Conservation Office, Flagstaff, Arizona. Interagency Acquisition No. 01-3022-R1009 (Task 2), Document No.: USFWS-AZFWCO-FL-10-03. 17 pp.
- 2) Data for the 2010 Chute Falls monitoring trip are archived at the Grand Canyon Monitoring and Research Center in one MS Access file entitled: LC20100601_LAtomizer.mdb. Data for the 2010 Chute Falls translocation trip are archived at the Grand Canyon Monitoring and Research Center in one MS Access files entitled: LC20100712_HBC Trans Trip.mdb
- 3) Van Haverbeke, D.R. 2010. The Humpback Chub of Grand Canyon. Pp. 261-268 *In* Melis, T.S., Hamill, J.F., Coggins, L.G. Jr., Bennett, G.E, Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E. eds. 2010, Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 372 p.

(6.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Mark-Recapture and Fish Monitoring Activities in the Little Colorado River in Grand Canyon During 2010. Open File Report expected draft delivery date to GCMRC on 31 January 2010.

(7.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

It is recommended that the annual effort to translocate humpback chub to above Chute Falls in the LCR be continued. Translocation of humpback chub to above Chute Falls has successfully operated as a rearing scenario for HBC, wherein most detrimental issues concerning genetics and ethology (behavior) are minimized compared to hatchery augmentation. Despite this year's low abundances of HBC above 13.57 km, all humpback chub above Chute Falls are now PIT tagged, and it is expected that this will facilitate tracking the growth, movement, and recruitment of these humpback chub to the LCR population as a whole.

It is also recommended that the annual effort to conduct mark recapture efforts in the LCR between 13.57 and 18.1 km be continued. Continued mark-recapture efforts in this section of the LCR will allow researchers to continue to assess important questions pertaining to: 1) the growth rates of translocated humpback chub, and 2) the survivorship, movement, and contribution to the LCR population as a whole of translocated humpback chub. Information on the survivorship in the wild of small PIT tagged humpback chub could prove valuable in the future should researchers identify a need to begin routinely PIT tagging small humpback chub (e.g., 60-150 mm) in the LCR for detection in the mainstem Nearshore Ecology Project. Finally, the mark-recapture effort in the small section of the LCR between 13.57 and 14.1 km serves to compliment the main spring and fall mark-recapture efforts in the LCR. Continuing monitoring in 2011 will serve to monitor those humpback chub that were translocated to above Chute Falls in 2010, and offers the unique opportunity to document natural reinvasion (if it occurs) of humpback chub into the small reach of river between 13.57 and 14.1 km (between Lower Atomizer Falls and Chute Falls).

(8.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY PLANNED GROSS BUDGET:		FISCAL YEAR NET AVAIL BAL: \$141,783
FISCAL YEAR EXPENDITURES:		\$127,244
FISCAL YEAR OBLIGATIONS:		\$141,829
END OF FISCAL YEAR AVAILABLE BALANCE:		<\$46>

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

SIGNATURE: (Must be signed or submitted by PM.)	Barbara Ralston	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ David R. Van Haverbeke	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		BIO 2.M4.10 Monitoring Mainstem Fishes (includes Diamond down) (Ongoing)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Andy Makinster, Arizona Game and Fish Department
E-mail:	bralston@usgs.gov	E-mail	amakinster@azgfd.gov
Telephone:	(928) 556-7455	Telephone:	623-236-7675
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The goal of this project is to provide status and trend information on the abundance and recruitment of the fish community in Grand Canyon. This project was started in 2000 to monitor fish relative abundance and distribution throughout Glen, Marble, and Grand Canyons. It was originally designed to focus on rainbow trout, brown trout, and common carp but has recently shown good results with flannelmouth sucker and bluehead sucker. The project utilizes standardized electroshocking to provide an index of relative abundance, distribution, and cohort strength for several species of fish that currently occupy the canyon. It is also utilized to detect nonnative species that are currently not abundant within the canyon but pose a threat to native fish if they become established.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>We sampled Glen and Grand Canyons April 1-April 21 (trip 1) and May 6–May 23 (trip 2), 2010. All inferences of relative catch rates downriver of the confluence of the Little Colorado River and the Colorado River were likely confounded by changes in turbidity between trip 1 and trip 2 and associated changes in capture probabilities. Rainbow trout relative abundance throughout the river has increased since 2006 and catch rates in 2010 were similar to those observed in 2001, and did not change from 2009. A similar trend was detected in rainbow trout relative abundance in the LCR reach during 2010. Relative abundance of flannelmouth and bluehead sucker in 2010 were the highest observed since 2000 indicating the large cohorts observed from 2004-2006 have recruited to the adult population.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>SSQ 1-1. To what extent are adult populations of native fish controlled by production of young fish from tributaries, spawning and incubation in the mainstem, survival of young-of-year and juvenile stages in the mainstem, or by changes in growth and maturation in the adult population as influenced by mainstem conditions?</p> <p>Humpback chub are sporadically observed during mainstem monitoring surveys due to their lessened vulnerability to electrofishing. However, flannelmouth and bluehead sucker appear to be vulnerable to this gear. Data from this project suggests relative strong cohorts of these fish were apparent during 2004-2006. Evidence from this project also suggests rainbow trout spawning is occurring in areas near the confluence of the LCR, suggesting future mechanical removal of this species may be necessary.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>Submitted Reports in 2010:</p> <p>-Bunch, A. J., L. A. Avery, Makinster, A. S., and W. T. Stewart. 2010. Grand Canyon Long-Term Fish Monitoring, 2010 Trip Report. Trip report submitted to the Grand Canyon Monitoring and Research Center, Flagstaff, AZ. Arizona Game and Fish Department, Phoenix, AZ. Cooperative Agreement No. G09AC00036. 13 pp.</p> <p>Presentations in 2010:</p> <p>Oral</p> <p>- Grand Canyon long-term fish monitoring, 2009 update. Colorado River Aquatic Biologists meeting, Laughlin, NV, Jan. 13-14, 2010.</p> <p>- Grand Canyon long-term fish monitoring, 2009 update. Technical Work Group meeting, Phoenix, AZ. Jan. 19, 2010.</p>			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			

Provide data for annual ASMR model update: January 2010					
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>					
Continue with mainstem fishes monitoring. Review protocol annually with fish cooperators' meeting. The FY 11 budget reduced this project from 2 trips per year to 1 trip per year. Turbidity is a concern if 1 trip is conducted as capture probabilities drastically change with high turbidity and may not allow for comparisons with previous years.					
(9.) FY2009 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:			09/28/2010
FY PLANNED GROSS BUDGET:		\$625,803	FISCAL YEAR NET AVAIL BAL:		\$559,662
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:				\$601,160	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$24,643	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries & travel underspent due to lapsed technician position					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/9/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Andrew Makinster	TITLE:	Principal Investigator	DATE:	12/9/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 2.R7.10: Stock Assessment of Native Fish in Grand Canyon	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	William Persons
E-mail:	bralston@usgs.gov	E-mail	wpersons@usgs.gov
Telephone:	(928) 556-7455	Telephone:	928-556-7323
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>This project will provide annual updates of size composition and capture rates of humpback chub (HBC) and other Grand Canyon fish to the Glen Canyon Dam Adaptive Management Program (GCDAMP) and other managers. Reporting will include retrospective time series to allow for comparison with previous years' data. The assembled HBC data from the Grand Canyon fish monitoring projects will be incorporated into updates of the Age-Structured Mark-Recapture (ASMR) model every 3 years (the next ASMR update will be published in 2012).</p> <p>This project will lead the analyses of existing fish capture information recommended by the 2009 Protocol Evaluation Panel (PEP) for Grand Canyon Fishes. The goal of these analyses is to evaluate whether the fish monitoring project changes recommended by the PEP, especially to reduce some efforts and increase others, are consistent with the available data.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>Analyses following the PEP recommendation were completed by Steve Martell from University of British Columbia at Vancouver. He reported his findings at the Fall TWG meeting. Recommendations included considering incorporating some randomization with the sample area of the LCR.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SA 1. What are the most limiting factors to successful humpback chub adult recruitment in the mainstem: spawning success, predation on YOY and juveniles, habitat (water, temperature), pathogens, adult maturation, food availability, competition? This question is partially addressed by this project, yet what specifically contributes to the estimated increases in adult HBC could be attributed to several factors. These factors include experimental releases between 2000 to 2008, mechanical removal of nonnative fishes near the Little Colorado inflow, and drought induced warming of the Colorado River below Glen Canyon Dam.</p> <p>SSQ 1-8. How can native and nonnative fishes best be monitored while minimizing impacts from capture and handling or sampling? This question will be addressed in 2010 in response to the Protocol Evaluation Panel review of the fish monitoring program in Grand Canyon. Using the ASMR model updated under this project, different monitoring scenarios will be evaluated (removing or increasing certain monitoring elements) or and the overall impact to model precision and accuracy will be determined.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
Presentation provided to TWG in November, 2010.			
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
<p>As monitoring efforts for HBC continue, so does the need to update the model and continually refine simulations so that the effect of experiments and management actions can be better evaluated. In addition, further development to improve ageing techniques that augment current methods using length will help reduce ageing errors and improve estimates.</p>			

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$108,528	FISCAL YEAR NET AVAIL BAL:		\$91,634
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$66,751	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$41,777	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries under spent due to delay in hiring biologist & technician					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	
SIGNATURE: (Must be signed or submitted by PI.)	/s/ William Persons	TITLE:	Principal Investigator	DATE:	

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 2.R13.10: Remote PIT Tag Reading (Ongoing)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	William Persons
E-mail:	bralston@usgs.gov	E-mail	wpersons@usgs.gov
Telephone:	928-556-7455	Telephone:	928-556-7323
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The goals of this project are to evaluate the efficiency of gears used for current monitoring as well as explore new monitoring methods that do not require repeated handling of fishes, or additional field sampling in the Little Colorado River (LCR). Remote antennae have been used to interrogate Passive Integrated Transponder (PIT) tags in fish that pass nearby. PIT tags are implanted in a large fraction of the adult population and to a lesser degree in the smaller life history stages of HBC in Grand Canyon. Antennae provide the opportunity to evaluate gear efficiency of hoop nets (e.g. what proportion of the fish present are captured) to increase precision of population estimates, direction and timing of movement within the LCR, and presence of fish in the LCR year round.</p> <p>A limited number of HBC and other native fishes are present in the modern-day Colorado River in Grand Canyon. Nonnative fish species are also present and are important to study because of the known predatory and competitive threats they pose to native fishes. Scientists and managers wish to know how many of these species are present, their spatial and temporal movement patterns, and the effectiveness of sampling gears in sampling populations; they also wish to obtain population information in the least intrusive manner(s) possible, especially when sampling the endangered HBC. Remote PIT-tag antennae have been shown to be very effective at continuous monitoring in other, generally smaller rivers and streams, alleviating the need for additional field sampling trips and multiple fish handling events.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>The major tasks for this project are to build, install, operate and maintain a PIT antennae interrogation system in the LCR as well as to evaluate and learn to use the system. Since 2004, a few small (60 cm square) antennae have been used in the LCR with limited success. In 2009, in cooperation with the U.S.G.S Cook WA Lab, a larger system consisting of six 6 x 0.6 m rectangular antennae was built and installed near approximately river kilometer 2 in the LCR. The six antennae array record to a single transceiver/scanner that records the date and time along with PIT tag detections. The system includes a solar power plant designed to keep the system operational year round. The system was installed and was operational May 2, 2009. After difficulties with signal noise interference and a very low read range (2-3 in), the system was modified to reduce signal noise and read range was increased in some cases to 10 inches</p> <p>Plans to install a second antenna array in 2010 were disrupted by sustained flows greater than 5,000 cfs and muddy water in the Little Colorado River during most of the spring, helicopter logistics difficulties, and monsoon season flooding in the late summer. The antenna installed during 2009 was dislodged and disconnected during spring 2010, and again in August 2010. Little data were collected during the period, and the multiplexor was removed to protect it from further high flows. A new set of antennas was built and delivered to GCMRC but have not been installed. Plans are to install the second antenna array, a new power plant and a modem to allow accessing the system from the office as soon as the LCR returns to base flow next spring (2011)</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SSQ 1-8. How can native and nonnative fishes best be monitored while minimizing impacts from capture and handling or sampling? This question is being directly addressed by this project to evaluate use of PIT antennae to detect tagged fish without subjecting the fish to capture and handling. During five months in 2009 more than 1000 unique fish were detected by the new antenna system. The old, smaller antennas also detected more than 1300 fish.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			

(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>					
Results will be summarized in the Arizona Game and Fish Department 2010 Little Colorado River Lower 1200 m stock assessment report by January 30, 2011. Further analyses of detection efficiency, hoopnet capture efficiency, and fish movement is anticipated for 2011.					
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>					
The project is planned to continue during 2011 with installation of a second antenna in the LCR, using modified antenna configurations to allow better estimates of detection efficiency and fish movement as well as remote telemetry capability to reduce field time to service and download the instruments. In addition, the FY11 work plan provides funding for a graduate student, and GCMRC is negotiating with Colorado State University for a student to lead future efforts.					
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010		
FY PLANNED GROSS BUDGET:	\$215,586	FISCAL YEAR NET AVAIL BAL:	\$195,579		
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:		\$230,180			
END OF FISCAL YEAR AVAILABLE BALANCE:		<\$14,594>			
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Suballocation for antennae over spent.					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/2010/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ William Persons	TITLE:	Principal Investigator	DATE:	12/2010/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 2.R15.10 Nearshore Ecology/Fall Steady Flows	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Mike Yard & Bill Pine
E-mail:	bralston@usgs.gov	E-mail	myard@usgs.gov, billpine@ufl.edu
Telephone:	(928) 556-7455	Telephone:	928-556-7377, (352)273-3650
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The Biological Opinion (BO; USDO I 2008) on the operation of Glen Canyon Dam identifies conservation measures necessary to conserve and protect the endangered humpback chub <i>Gila cypha</i>. Experimental flows described in the BO were recently implemented that include a 2-month period of steady discharge during fall (September and October) over the next 5 years (2008-2012). A study program called the Near Shoreline Ecology (NSE) project was developed in 2008 for understanding how prescriptive flow operations influenced ecological attributes of near shoreline habitats and to determine the relative importance of such habitats to important life stages of native and nonnative fishes. To implement the NSE, the Grand Canyon Monitoring and Research Center (GCMRC) developed a competitive solicitation to identify partners to accomplish the research goals by a cooperative agreement. This solicitation was developed with input from Bureau of Reclamation, U.S. Fish and Wildlife Service, and the National Park Service and reviewed by the Glen Canyon Dam Adaptive Management Program (GCDAMP) Science Advisors. The purpose of the solicitation was to understand how river flow, through its interaction with physical habitat structure, influences the survival and growth rates of juvenile native and non-native fishes in the Colorado River in Grand Canyon. The NSE project is intended to provide new insight into juvenile fish ecology, with a focus on humpback chub, with the flow and habitat management capabilities of the Glen Canyon Dam (GCD) Adaptive Management Program (AMP). Findings from this study will provide information to better understand how flow and habitat management can be used to cultivate and enhance survival and growth of juvenile native fish, and guide future GCDAMP recommendations for the Department of the Interior to consider as management or experimental actions.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>Release of the NSE solicitation occurred during the Fall 2008, which was followed by an independent panel review to assess and select the best proposal. An extensive NSE review process was conducted for all submitted proposals; this process resulted in an award being made in early 2009 to the University of Florida, principal Investigators: Drs. William E. Pine, III, J. Korman, Karin E. Limburg, Mike S. Allen, and Thomas K. Frazer. The primary focus of this proposed research project will be to address two key research questions, these questions are: 1) Do steadier flows during summer and/or fall increase survival rates of juvenile native and non-native fish?, and 2) To what extent do physical habitat structures (e.g., sand bars and backwaters), in conjunction with flows during these periods, influence survival rate? The research questions will be addressed by linking results to a proposed conceptual model for humpback chub <i>Gila cypha</i> (HBC) and other native and nonnative fish by using an approach to assess shifts in fish density by tracking habitat specific abundance and survival of native and non-native fish in response to changing nearshore habitat availability related to and created by the fall steady flow experiment, and then by determining the source populations of juvenile native fish that populate nearshore habitats created by the proposed Fall Steady Experimental Flow (FSEF).</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Four monthly research trips (July-October) were conducted in 2009, and repeated again in 2010. Sampling periods were selected to compare and contrast differences in the fish community in response to fluctuating and steady flows. These trips provided the design framework to estimate growth, survival, and abundance by habitat type. This study design is based on a robust design mark-recapture approach that would estimate habitat specific abundance for each trip using closed models, and relax the assumption of population closure between sampling trips.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>An annual report for 2009 was submitted to GCMRC by the NSE principal investigators. In 2009, a total of 12,000 fish from 14 identifiable species were caught during the scheduled trips. Humpback chub represented between 3 and 22% of the total catch in electrofishing and between 52 and 81% of total hoop net catch. Size</p>			

frequency analyses showed that both gear types captured a wide size range of fish but electrofishing generally captured smaller fish than hoopnets. Catches of HBC of all sizes by gear and trip were widely distributed throughout each site from electrofishing and a similar pattern is apparent for HBC in hoopnet samples. Movement patterns of HBC within a trip were generally restricted to the site of tagging with the majority of recaptures occurring in the same site in which the fish was tagged. Capture probabilities were assessed for juvenile HBC in three different size classes, sample, and gear and found that across these attributes capture probabilities were generally low (about 4-13%) with limited recaptures.

Abundance was estimated for juvenile HBC using closed population models. Abundance of HBC < 100-mm TL maximum likelihood estimates (MLEs) and uncertainty profiles for each site and trip show that abundance in Sites 1 and 2 were fairly similar (approximately 500 -1000 fish). Estimates for Site 3 were slightly lower with MLE estimates < 500 fish. Findings from the mark-recapture study, indicate that due to low recapture rates that at least three nights of sampling are needed to generate estimates of abundance using electrofishing and seven nights of sampling are needed for hoopnetting.

Water analyses revealed strong differences in several trace elemental and isotopic composition, with some tributaries (notably Paria, Little Colorado and Nankowep) showing periodically high levels of trace elements (e.g., cobalt, copper, lead, rubidium, and selenium). In particular, the Little Colorado River is separated extraordinarily well by $\delta^{13}C$ from most of the other sites, although Havasu Creek has values somewhat close. Principal components analysis, along with visual inspection of the data, emphasizes the fact that the mainstem "chemical fingerprint" is highly consistent from Lee's Ferry down past Diamond Creek. Of the fifty-four trace elements quantified using LA-ICPMS techniques, only seven elements were consistently above detection limits. These distinct peaks suggest that fish were undertaking directed movements between locations with different water chemistry or alternatively, or the fish were not moving and water chemistry was changing in the system. Results of the synchrotron x-ray fluorescence analyses confirmed patterns observed in LA-ICPMS analyses for elements quantified using both analytical techniques. Except for two fish collected in the Little Colorado River that had distinct regions of higher Cu:Ca concentration near the otolith core, most otoliths displayed uniform elemental ratios and little patterning across the otolith surface. Using SIMS technique, carbon and oxygen stable isotopes were quantified at two locations on the otolith from the 33-mm Colorado River HBC, 11 locations on the 64-mm LCR Boulder Camp FMS otolith, and at one location (core) on the 14-mm BHS. The similarity between the BHS chemistry and HBC core chemistry suggest that the HBC was spawned in the LCR and subsequently migrated to the MS where it incorporated a lower $\delta^{13}C$ and $\delta^{18}O$ otolith chemistry.

For the 2009 sampling period, tables and figures are provided that summarize study findings for fish catch, size class distribution, abundance, age-growth, water chemistry and otolith analyses. Results can be found in the 2009 NSE annual report.

The 2010 field work was completed as scheduled, which consisted of two trips prior to the steady flow experiment (launch dates of mid-July and mid-August) and two trips following the start of the steady flow experiment (experiment begins September 1, trip launch dates early September and mid-October).

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Currently, the NSE project is completing the data entry process, and is developing the model structures used for the different types of abundance and age/growth analyses. A final report for the second year of data collection (2010) is expected to be completed by April 1, 2011.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Owing to the recent development of this study program and only preliminary findings, no recommendations can be made at this juncture of time.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY10 PLANNED GROSS BUDGET:	\$0	FISCAL YEAR NET AVAIL BAL:
		\$0
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:		\$17,979
END OF FISCAL YEAR AVAILABLE BALANCE:		<\$17,979

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Supplemental funding for additional salaries, travel and supplies not included in appropriated funding.

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/08/2010
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SIGNATURE: (Must be signed or submitted by PI.)	/s/ Mike Yard /s/ Bill Pine	TITLE:	Principal Investigator	DATE:	12/08/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 2.R16.09 Mainstem Nonnative (coldwater) Fish Control	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	N/A
E-mail:	bralston@usgs.gov	E-mail	
Telephone:	(928) 556-7455	Telephone:	
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>Rainbow trout have been implicated as a threat to native fishes in habitats where RBT have been introduced, including the confluence of the Colorado and Little Colorado Rivers in Grand Canyon. Information from personnel monitoring fish in the confluence reach suggests the rainbow trout population has rebounded following the 2003-2006 removal effort. Thus, this project launched a single trip during April 30-May 20, 2009 to enumerate and control rainbow trout in the confluence reach (RM 56-66). The goals of this project are as follows include calculating the abundance of RBT in the confluence reach of the Colorado River, reduce the abundance of RBT in the confluence reach and reduce the abundance of other nonnative fishes captured as by catch by this effort.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
None to report. Project cancelled for FY10			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SSQ 1-2. Does a decrease in the abundance of rainbow trout (RBT) and other cold- and warm water nonnatives in Marble and eastern Grand Canyons result in an improvement in the recruitment rate of juvenile humpback chub to the adult population? This cannot be answered at this time.</p> <p>SSQ 1-4. Can long-term decreases in abundance of RBT in Marble and eastern Grand Canyons be sustained with a reduced level of effort of mechanical removal or will recolonization from tributaries and from downstream and upstream of the removal reach require that mechanical removal be an ongoing management action? This question also applies to future removal programs targeting other nonnative species. We ran model simulations to determine if the effort undertaken in 2009 was adequate to maintain the rainbow trout population in the LCR reach at 10% of that observed in 2003. Model simulations showed a single trip, with low and high rates of immigration into the reach, was inadequate to maintain the population at this desired level. Two trips per year with low and high immigration rates lowered the population to the desired level but the population rebounded quickly. Similar results were found with three trips per year and a low immigration rate. If the immigration rate was high, however, the population again rebounded relatively rapidly.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
N/A			
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)			
N/A			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
N/A			
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$104,765	FISCAL YEAR NET AVAIL BAL:	\$54,894
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$27,163

END OF FISCAL YEAR AVAILABLE BALANCE:		\$77,602			
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Project cancelled; retained 20% of logistics budget and returned \$77,602 to Reclamation					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 2.R17.10: Nonnative Control Plan Science Support	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Kara Hilwig
E-mail:	bralston@usgs.gov	E-mail	bralston@usg.gov
Telephone:	(928) 556-7455	Telephone:	928-556-7455
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The specific goal of this project is to evaluate threats to native fishes resulting from nonnative fishes, to develop a plan to control those species that pose the greatest threats to natives, and to test implementation of this plan (see project BIO2.R6.09). This project is expected to be complete in March 2011.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>GCMRC staff conducted a comprehensive review of historical nonnative fish captures in Grand Canyon and presented this information at the Nonnative Fish Workshop in Dec 2009. GCMRC received and incorporated comments from the Science Advisors on the control plan (Nonnative Fishes Control in Grand Canyon: Historical Perspectives and Recommendations for Monitoring, Control and Research). The SAs recommended that a two part approach (short and long term) be reconsidered. GCMRC staff restructured the approach to include one document representing the control plan which will be followed by a risk assessment document in September 2010. GCMRC received TWG comments on the control plan and final revision of this document is scheduled for January 2011.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>New SSQ-A. What are the most effective strategies and control methods to limit nonnative fish predation on, and competition with, native fishes?</p> <p>SSQ 5-6. Do the potential benefits of improved rearing habitat (warmer, more stable, more backwater and vegetated shorelines, more food) outweigh negative impacts due to increases in nonnative fish abundance? Within the Nonnative Fishes Control in Grand Canyon document, the authors provide recommendations for nonnative fish control, monitoring improvements, and research and institutional needs required to increase the ability to effectively and efficiently apply nonnative fish control strategies to benefit native fish. One of the research recommendations in this document is the development of a risk assessment to evaluate specific impacts of nonnative fish on juvenile humpback chub. Various temperature scenarios will also be modeled to assess future river warming.</p> <p>New SSQ-B. What life stage(s) of rainbow trout pose the greatest threat to humpback chub and other native fishes? Are the rainbow trout that threaten humpback chub resident fish produced in the Little Colorado River reach of the Colorado River, or are these rainbow trout immigrants that were spawned in the Lees Ferry reach?</p> <p>SSQ 1-4. Can long-term decreases in abundance of rainbow trout in Marble and eastern Grand Canyons be sustained with a reduced level of effort of mechanical removal or will recolonization from tributaries and from downstream and upstream of the removal reach require that mechanical removal be an ongoing management action?</p> <p>SSQ 1-7. Which tributary and mainstem habitats are most important to native fishes and how can these habitats best be made useable and maintained? See BIO 2.R16.09 Mainstem Nonnative Fish Control for knowledge summary for New SSQ-B, SSQ 1-4 and SSQ 1-7.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<p>Multiple revisions of the Nonnative Fishes Control in Grand Canyon document were completed in FY10. A final document is planned in FY11. Progress has been made toward developing a nonnative fish risk assessment utilizing bioenergetics and ecosystem modeling approaches. The final risk assessment is due for completion March 2011.</p> <p>Presentations will be given to professional conferences and to the AMWG and TWG. Delays in finalizing reports are due to personnel changes within GCMRC</p>			

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Continued science support and advancement of nonnative fish control through assimilation of the most current pertinent literature in annual work plans

1. Continued science support for the development of the risk assessment
2. Continued science support for the development of nonnative fish early detection and monitoring protocols

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$78,773	FISCAL YEAR NET AVAIL BAL:		\$66,511
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$66,429	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$12,344	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries under spent due to lapsed technician position					
SIGNATURE: (Must be signed or submitted by PM.)		/s/ Barbara Ralston	TITLE:	Program Manager	DATE: 12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		BIO 2.R18.10: Natal Origins of rainbow trout in Grand Canyon	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Matthew Andersen
E-mail:	bralston@usgs.gov	E-mail	mandersen@usgs.gov
Telephone:	(928) 556-7455	Telephone:	
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>This project will investigate where rainbow trout (RBT) reproduce in the Colorado River between Glen Canyon Dam and Tanner Rapid. This project seeks to combine results from available literature and currently collected data to develop a report describing the evidence for where RBT are reproducing, or their location of natal origin.</p> <p>This project will use both peer-reviewed and grey literature and the results of ongoing studies to investigate the natal origins of RBT in Glen, Marble, and Grand Canyons. Studies and publications on this population have been produced by GCMRC, AZGFD, Ecometric, Inc., U.S. Fish and Wildlife Service, Arizona State University, and others over the years, so a bibliography will be assembled and used as a basis for a manuscript on the subject of the natal origins of RBT.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Input from ecosystem modeling provide the best inferential data about the origins of rbt in Grand Canyon that suggests they originate from upstream in Lees Ferry. A specific report was not developed; further reporting needs will be considered in the context of the Paria of badger Study</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>Primary SSQ addressed:</p> <p>SSQ 1-3. Do RBT emigrate from Glen to Marble and eastern Grand Canyons, and, if so, during what life stages? To what extent do Glen Canyon emigrants support the population in Marble and eastern Grand Canyon?</p> <p>SSQ 1-4. Can long-term decreases in abundance of RBT in Marble and eastern Grand Canyons be sustained with a reduced level of effort of mechanical removal or will re-colonization from tributaries and from downstream and upstream of the removal reach require that mechanical removal be an ongoing management action?</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>The natal origins of trout were evaluated in the Ecosystem Modeling workshops and the structured decision making workshops</p>			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<p>Reporting needs will be considered in the context of the Paria of Badger Study and other nonnative fish control/research needs identified in the nonnative EA.</p>			
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>			
<p>The Paria to Badger Rapid (PBR) reach study will provide data relevant to this question,</p>			
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	0	FISCAL YEAR NET AVAIL BAL:	0
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			0
END OF FISCAL YEAR AVAILABLE BALANCE:			0
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>			

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 4.M2.10 Monitoring Lees Ferry trout (Ongoing)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Andy Makinster, Arizona Game and Fish Department
E-mail:	bralston@usgs.gov	E-mail	amakinster@azgfd.gov
Telephone:	(928) 556-7455	Telephone:	(623) 236-7675
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>Monitor the rainbow trout fishery in the Lees Ferry reach to determine status and trends in abundance (population size and catch per unit effort), population structure (size composition), distribution, reproductive success, growth rate, length-weight relationship, relative condition (Kn) and overall recruitment to reproductive size, in response to Glen Canyon Dam operations. Further objectives consist of (1) continuing development of stock assessment models for Lees Ferry rainbow trout, and (2) monitoring the fishery for whirling disease.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>We sampled the Lees Ferry tailwater in 2010 during April 27-30 (trip 1) and October 26-30 (trip 2). It appears that spawning continues to be successful and age-0 survival high. It appears that over-winter survival is low or that there is some emigration occurring. Adult fish sampled throughout 2010 were robust and in good condition though lower in abundance. Angler satisfaction was reported as high. During the October sampling, roughly 70 young of the year rainbow trout were sacrificed and sent to the Washington Animal Disease Diagnostic Laboratory (WADDL) for whirling disease analysis. The results for samples sent in October are not available at the time of this report. Completion of the analysis is expected in December 2010.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SSQ 3-6. What GCD operations (ramping rates, daily flow range, etc.) maximize trout fishing opportunities and catchability? Data collected in 2008 (including prior to and following the 2008 HFE) suggests the experiment had a positive impact on the aquatic foodbase in Lees Ferry and the rainbow trout found within, particularly for young fish. Evidence of strong cohorts in 2008 through 2010 suggests young fish in the reach have benefited not only from the HFE but also the steady flow regime that has occurred in September and October of both years. A decrease in age-1 fish for 2010 suggests the population is experiencing density dependant constraints resulting in a lack of recruitment or in increased emigration. Relative condition has decreased for age-0 fish only and remains steady or has increased slightly for all other age classes.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>- Avery, L. A., A. S. Makinster and W. Stewart. 2010. Lees Ferry long term rainbow trout monitoring; April 2010 Trip Report (Trip LF20100427). Trip Report submitted to the Grand Canyon Monitoring and Research Center, Flagstaff, AZ. Arizona Game and Fish Department, Phoenix, AZ. Cooperative Agreement No. 05WRAG0050-Mod 7. 15 pp.</p> <p>-Avery, L. A., A. S. Makinster and W. Stewart. 2010. Lees Ferry long term rainbow trout monitoring; October 2010 Trip Report (Trip LF20101026). Trip Report submitted to the Grand Canyon Monitoring and Research Center, Flagstaff, AZ. Arizona Game and Fish Department, Phoenix, AZ. Cooperative Agreement No. 05WRAG0050-Mod 7. 15 pp.</p>			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
-Status and trends of the Lees Ferry rainbow trout population, 2010 Annual Report. <i>Expected delivery:</i> January 2010.			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
<p>The 2009 PEP panel evaluated the Lees Ferry monitoring project and suggested sampling the adult rainbow trout population 1-2 times per year (versus a minimum of 3 per year) and an increased effort to focus on detecting trends in warm water non-native fish found within the reach. Preliminary analyses suggest there was a loss of</p>			

resolution in data interpretation with the loss of the summer trip and it is suggested that all three seasonal trips be included in future monitoring. Benefits of the efforts put towards monitoring warm-water non-natives are still unclear.

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY PLANNED GROSS BUDGET:	\$175,228	FISCAL YEAR NET AVAIL BAL:	\$162,858
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:			\$173,542
END OF FISCAL YEAR AVAILABLE BALANCE:			\$1,686

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Salaries underspent due to lapsed technician position

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/09/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Andy Makinster	TITLE:	Principal Investigator	DATE:	12/9/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 5.R1.10 Monitor Kanab Ambersnail	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston, Acting PM	Principal Investigator:	Jeff Sorensen
E-mail:	bralston@usgs.gov	E-mail	jsorensen@azgfd.gov
Telephone:	(928) 556-7455	Telephone:	623-236-7740
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
Monitor Kanab ambersnail (KAS) (from the FY2009 AWP)—determine the extent and kind of vegetation that exists as habitat for the KAS and to track the abundance and distribution of KAS at Vaseys Paradise. Compile data and produce an annual report.			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
Monitor Kanab ambersnail Objectives: Determine the extent and kind of vegetation that exists as habitat for the KAS and to track the abundance and distribution of KAS at Vaseys Paradise. Completed. Ambersnail population surveys were conducted in April 2010 (using "citizen science" volunteers on a chartered commercial river trip, as approved by NPS), in September 2009 (with the assistance of NPS). Timed presence-absence sampling and a subset of 20-cm diameter plot sampling of occupied habitat was conducted on all site visits.			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
From FY2009 AWP—"There are no SSQs that are directly related to the goal of maintaining or attaining viable KAS populations."			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
None			
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)			
Kanab Ambersnail 2006-2009 Arizona Status Report. Nongame and Endangered Wildlife Program Technical Report 258. Arizona Game and Fish Department, Phoenix, Arizona). Annual data files submission in December 2010.			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
Determine if NPS can take complete responsibility for this project in coordination with AZGFD and be responsible for reporting on findings.			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$24,636	FISCAL YEAR NET AVAIL BAL:
			\$22,640
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$20,090
END OF FISCAL YEAR AVAILABLE BALANCE:			\$4,546
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)			
Cooperators under spent due to lesser budget than expected			
SIGNATURE: (Must be /s/ or	/s/ Barbara Ralston	TITLE:	Program Manager
		DATE:	12/08/2010

submitted by PM.)					
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 6.M1.10 Vegetation Mapping	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston, Acting PM	Principal Investigator:	Barbara E. Ralston
E-mail:	bralston@usgs.gov	E-mail	bralston@usgs.gov
Telephone:	(928) 556-7455	Telephone:	928 556-7455
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The goals of this project are to determine the areal extent of vegetation classes among the major habitats zones in the Colorado River ecosystem (CRE) (e.g., new high-water zone, sand beach community, old high-water zone) and to compare extent between years for change detection of riparian species</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Identified areas on the ground for accuracy assessment of 2005 imagery in May 2009. Classification of 2005 imagery will be done in conjunction with 2009 total vegetated area change for a multi-year assessment. Delays are due to involvement with completing LSSF report, HFE synthesis.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>Vegetation mapping is a component of the proposed core monitoring program for terrestrial resources. It is intended to address SSQ 2-1. Do dam-controlled flows affect (increase or decrease) rates of erosion and vegetation growth at archaeological sites and TCP sites, and if so, how? The mapping component of monitoring quantifies total vegetation change throughout the river corridor including the old high water zone and is also intended to assess area changes of classes of woody vegetation and marsh/wetland vegetation. In a four-year time frame, rates of change of woody vegetation classes can inform how annual flow volumes vegetation growth with respect to areal cover.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
None			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
SIR of vegetation change analysis for 2002 through 2009.			
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>			
<p>Depending on outcome of classification accuracies may reconsider the utility of classify vegetation beyond woody vegetation and marsh areas. This would still allow quantification of vegetation change within identified habitats (e.g., NHWZ, OHWZ, debris fans, sandbars).</p>			
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$93,798	FISCAL YEAR NET AVAIL BAL:	\$79,197
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$84,532
END OF FISCAL YEAR AVAILABLE BALANCE:			\$9,265
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>			
Salaries and travel under spent			
SIGNATURE: <i>(Must be /s/ or submitted by PM.)</i>	/s/ Barbara Ralston	TITLE:	Program Manager
		DATE:	12/08/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 6.R2.10 Vegetation Transects	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Barbara Ralston
E-mail:	<i>bralston@usgs.gov</i>	E-mail	<i>bralston@usgs.gov</i>
Telephone:	(928) 556-7455	Telephone:	(928) 556-7455
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP</i>			
<p>Riparian vegetation expansion, since operations at Glen Canyon Dam (GCD) began in 1963, has had a pivotal role in the ecology of the post dam river corridor. The plants associated with the expansion include alien species like salt cedar (<i>Tamarix ramossisma</i>), camel thorn (<i>Alhagi maurorum</i>), and peppergrass (<i>Lepidium latifolium</i>), but also native species, arrowweed (<i>Pluchea sericea</i>), seepwillow (<i>Baccharis emoryi</i>), and coyote willow (<i>Salix exigua</i>). The increase in terrestrial vegetation contributes to above ground primary productivity, arthropod densities and associated food resources for terrestrial and aquatic vertebrates, is a source of culturally important plant species and also can cause conflicts with recreational activities like available camping area. Because riparian vegetation is linked to multiple resources, knowing how vegetation is changing via monitoring (e.g., which species are expanding or declining and where) is an important source of data when evaluating dam operations. <i>The goal of this project is to determine how yearly GCD operations affect herbaceous species cover, richness, diversity, and wetland indicator values by surface elevation.</i></p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Initiated development of responses to PEP recommendations. Sampling design - The goal of this study is to develop a survey design specifically focused on long-term monitoring of target resources based on physical features and fluvial processes that impact terrestrial biological resources. This project will employ a two-stage, stratified random sample based on both landscape and local geomorphology to monitor terrestrial riparian resources. Landscape-scale strata are based on combined geomorphic reaches as defined by Schmidt and Graf (1990) and regional flora. Local-scale strata will be based on fluvial geomorphic features: debris fans, eddies, pools, and cobble bars. The response design initially will focus on sampling vegetation metrics, but selected sites will be suitable to serve as sample sites for integrated surveys of additional biological resources, such as birds and invertebrates.</p> <p>This project is determined to be completed by the end of 2010 and implemented during the 2011 field season. All products listed in number 6 will be completed by December 31, 2010. Currently the primary decisions have been made concerning the development of the sample sites. Code has been written and a test sample has been selected based on a two-stage generalized random tessellation stratified survey design. No final products have been completed at this time.</p> <p>Pilot project for arthropod monitoring in Glen Canyon National Recreation Area to evaluate efficacy of seasonal monitoring of pitfall traps.</p> <p>Key findings - We compared arthropod communities in three habitats (New High Water Zone, Old High Water Zone, and a Re-vegetation site) from May through September 2009.</p> <ul style="list-style-type: none"> -Our results showed clear differences in arthropod community structure among habitats, with the highest abundance and species richness in OHW and the lowest in the newly revegetated site. -Differences were evident when we examined all 76 species and when we examined representatives of the Coleoptera, Hymenoptera, and Arachnida families separately. Coleoptera and Hymenoptera were more abundant in OHWZ and Arachnida was more abundant in the NHW. - We observed clear overall patterns as well as specific trends within these larger patterns, including observing a number of species that were more common in the newly revegetated site. Several indicator taxa were identified for each of the three habitat types. - These results support the use of our pitfall trap design and sampling protocol for use in long-term monitoring of ground-dwelling arthropods. It is a viable method that uses a diverse group of organisms to assess ecological patterns that clearly reflect changes in types of habitats and disturbances to habitats. 			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			

Vegetation transect work is a component of the proposed core monitoring program for terrestrial resources. It is intended to address **SSQ 2-1**. Do dam-controlled flows affect (increase or decrease) rates of erosion and vegetation growth at archaeological sites and TCP sites, and if so, how? The transect component of monitoring quantifies vegetation change with respect to species richness, diversity and relative cover for individual species. It also determines changes in nonnative/native species ratios over time. This effort provides a more detailed view of vegetation change among hydrologic zones by identifying the presence of all species occurring within plots whereas the vegetation mapping component identifies change for dominant cover classes.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

Products a final report and sampling plan for vegetation monitoring are currently in progress, to be completed by the end of 2010.

Pitfall trap draft Open-File report is out for external peer review.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Tasks to be completed by December 31 include selection of sample sites for the 2011 field season based on a multi-stage, stratified random selection and a report outlining site selection details including R code, GIS input and output files, and associated metadata. The report will include a detailed response design as well as suggestions for collecting and storing data as well as data analysis approaches dictated by the survey design.

USGS OFR – Developing a protocol for long-term monitoring of ground-dwelling arthropods in riparian habitats along the Colorado River, Glen Canyon National Recreation Area.

Journal article – Ground dwelling arthropod assemblage among relict and post-dam riparian communities.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

(9.) FY2009 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		
FY PLANNED GROSS BUDGET:	0	FISCAL YEAR NET AVAIL BAL:	0
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:	0		
END OF FISCAL YEAR AVAILABLE BALANCE:	0		

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Funding from prior obligations.

SIGNATURE: (Must be /s/ or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/08/2010
SIGNATURE: (Must be /s/ or submitted by PI.)	/s/ Barbara Ralston	TITLE:	Principal Investigator	DATE:	12/04/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		BIO 6.R3.10 Vegetation Synthesis	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston, Acting PM	Principal Investigator:	Barbara E. Ralston
E-mail:	bralston@usgs.gov	E-mail	bralston@usgs.gov
Telephone:	(928) 556-7455	Telephone:	928 556-7455
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The goal of this project is to utilize existing data from previous investigations associated with the riparian zone to characterize temporal and spatial responses of riparian vegetation to GCD operations. Characterization can include compositional changes in species over time and the effects of spatial scale on data interpretation. Results of both aspects have implications for long-term monitoring approaches for riparian vegetation in terms of frequency and sampling location aspects.</p> <p>Terrestrial contribution to aquatic systems – Quantifying annual inputs from riparian and marsh vegetation.</p> <p>Western Honey Mesquite Review - The objective of this project was to study the ecological status of western honey mesquite in Grand Canyon, with an emphasis on how its current establishment along the post-dam shoreline is affecting the riparian community that has established there since the damming of the Colorado River in 1963.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Quantification of annual allochthonous of marsh and riparian vegetation to the aquatic system in the Colorado River ecosystem. Manuscript published in July 2010 in River Research and Applications.</p> <p>Developed draft report and completed lab analysis associate with Western Honey Mesquite Status - This study considered the affect of western honey mesquite on the riparian plant community in Grand Canyon and determined that it is having a very positive on riparian plant species there, including contributions on nitrogen to what is an increasingly nitrogen-limited system, and possibly even affecting increased growth of individual plants growing adjacent to mesquite. These results are based on nitrogen isotope analyses of plant tissue and soil samples taken throughout the Grand Canyon. Such an effect stands to increase the vitality and probably overall diversity of this ecosystem.</p> <p>Western honey mesquite's population in Grand Canyon, extending for more than 300 kilometers, may be the largest and healthiest throughout its southwestern distribution. This study has determined It is an expanding population in the new high water zone, with considerable recruitment in the new high water zone. Mesquite is most actively colonizing debris fans and cobble bars, habitats which are losing sediment. The presence of this deeply and widely rooted plant in such settings stands to help stabilize soils, in addition to enriching them for colonization by other riparian plant species.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>This project most closely relates to the SSQ 2-1. Do dam-controlled flows affect (increase or decrease) rates of erosion and vegetation growth at archaeological sites and TCP sites, and if so, how? SSQ 4-2. How important are backwaters and vegetated shoreline habitats to the overall growth and survival of YoY and juvenile native fish? Does the long-term benefit of increasing these habitats outweigh short-term potential costs (displacement and possible mortality of young humpback chub) associated with high flows? By providing a review of how vegetation has changed in the system and what flow elements (e.g., magnitude, duration, timing) influence vegetation change, these components this information can be related to projected TCPs and potential allochthonous inputs that affect productivity (detritus as well as arthropod contributions) in the aquatic arena. Long-term changes in the NHWZ with the migration of mesquite into this area suggests that this plant, through its nitrogen-fixing capabilities, may act as a nurse plant for some species by providing nitrogen in a nutrient poor system.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>Draft report for internal review of western honey mesquite report/ Kennedy, T.A., and Ralston, B.E., 2010, Regulation leads to increases in riparian vegetation, but not direct allochthonous inputs, along the Colorado River in Grand Canyon, Arizona: River Research and Applications, doi: 10.1002/rra.1431, p. n/a-n/a, http://dx.doi.org/2010.1002/rra.1431.</p>			

(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)					
Journal article for honey mesquite for publication in FY11.					
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)					
Provide small monetary support for riparian research projects annually.					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$37,710	FISCAL YEAR NET AVAIL BAL:		\$31,840
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$38,195	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$485>	
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)					
SIGNATURE: (Must be /s/ or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/08/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PHY 7.M1.10 Integrated Quality of Water (downstream of Glen Canyon Dam)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	David J. Topping
E-mail:	<i>pgrams@usgs.gov</i>	E-mail	<i>dtopping@usgs.gov</i>
Telephone:	(928) 556-7458	Telephone:	928-556-7445
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The Downstream Integrated Quality-of-Water (DSIQW) Core Monitoring Project is focused on high-resolution monitoring of stage, discharge, water temperature, specific conductance, dissolved oxygen, turbidity, and suspended-sediment concentration and particle size and a number of mainstem and tributary sites located throughout the Colorado River Ecosystem (CRE). These data are used to inform managers on the physical status of the Colorado River in the CRE and how this physical status is affected by dam operations in near real-time. The high-resolution suspended-sediment data collected under this project is used to construct the mass-balance sediment budgets used by managers to plan dam releases (including triggering BHBf tests). Details of this project (including descriptions of the data-collection locations) are provided in the GCMRC Annual Work Plan under Goal 7.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>In summary, the DSIQW project coordinated the collection of stage, discharge, and water-quality monitoring data at 7 mainstem locations and 8 major tributary locations and 8 lesser tributary locations during FY 2010 (suspended sediment is monitored at a subset of 5 mainstem and 16 tributary locations). Following the transition from research & development to core monitoring, instrument calibrations have been finalized and are now being verified. This work has resulted in the ability in FY 2009 to serve water quality data and update it on monthly (or more frequent) basis.</p> <p>Specifically, progress was made on many fronts within the DSIQW project:</p> <ol style="list-style-type: none"> 1) All monitoring data required by this project were collected. Processing of these data is mostly complete except for laboratory analysis of some of the suspended-sediment data from the Paria River. 2) High-resolution water-temperature, specific-conductance, and suspended-sediment concentration and grain-size data served on the web. These data are updated as frequently as every month, depending on data-collection location. 3) High-resolution turbidity data are being served on the web this winter. 4) 4 peer-reviewed reports were published during 2010 from this project on results from the 2008 HFE. See 2008 HFE final report for a listing of these reports. 5) 10 peer-reviewed reports were published during 2010 from this project on normal core-monitoring tasks. These reports are listed below in box 6. 6) 1 report on core-monitoring tasks has been through USGS review and is awaiting USGS approval (see box 7). 7) 2 reports on core-monitoring tasks will be entering USGS review this winter. 8) Completed delivery of historical period of record Little Colorado River mainstem unit-value stage and discharge to GCMRC database. This means that all wy 1926-1995 data from the Little Colorado River at Grand Falls, Arizona, gaging station and all wy 1947-present data from the Little Colorado River near Cameron, Arizona, gaging station are in the database and posted on the web. 9) Substantial progress was also made on completing the delivery of the historical periods of record for unit-value stage and discharge for gaging stations on Bright Angel and Kanab Creeks. Data from wy 1943-1970, 1991-1993, and 2006-2010 for the Bright Angel Creek near Grand Canyon, Arizona, gaging station are now posted on the web; data from wy 1964-1970 for the Kanab Creek near Fredonia, Arizona, gaging station are now posted on the web. 			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>The Goal 7 monitoring directly addresses the strategic science question: Is there a "Flow-Only" operation (i.e., a strategy for dam releases, including managing tributary inputs with BHBf's, without sediment augmentation) that will restore and maintain sandbar habitats over decadal timescales? This project addresses this question by monitoring tributary inputs and the status of the sediment budget, by reach, in the Colorado River. This information is used to</p>			

determine when high flows are appropriate and to monitor the results. This monitoring program addresses the implementation of this science question, additional monitoring is required to assess the efficacy over decadal timescales (see Goal 8).

The Goal 7 monitoring also directly address the strategic science question 5-1 regarding water temperature by monitoring mainstem water temperature at several locations.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

- 1) Several presentations at TWG and AMWG meetings.
- 2) The following peer-reviewed journal articles, USGS reports, and proceedings papers were published. (See 2008 HFE final report for a listing of four additional reports from this project.)

Topping, D.J., Rubin, D.M., Wright, S.A., and Melis, T.S., in press, Field evaluation of the error arising from inadequate time averaging in the standard use of depth-integrating suspended-sediment samplers: U.S. Geological Survey Professional Paper 1774.

Griffiths, R.E., Topping, D.J., McDonald, R.R., and Sabol, T.A., 2010, The use of the multi-dimensional surface-water modeling system (MD_SWMS) in calculating discharge and sediment transport in remote ephemeral streams: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Rubin, D.M., Topping, D.J., Chezar, H., Hazel, J.E., Schmidt, J.C., Breedlove, M., Melis, T.S., and Grams, P.E., 2010, 20,000 grain-size observations from the bed of the Colorado River, and implications for sediment transport through Grand Canyon: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Sabol, T.A., Topping, D.J., and Griffiths, R.E., 2010, Field evaluation of sediment-concentration errors arising from non-isokinetic intake efficiency in depth-integrating suspended-sediment bag samplers: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Tusso, R., Rubin, D.M., Topping, D.J., Chezar, H., and Breedlove B., 2010, Using changes in bed-surface grain size as a proxy for changes in bed sand storage, Colorado River, Grand Canyon, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010–5135, p. 347-355.

Voichick, N., and Topping, D.J., 2010, Use of specific conductance in estimating salinity and as a natural tracer of water parcels in the Colorado River between Glen Canyon Dam and Diamond Creek, northern Arizona, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010–5135, p. 357-362.

Voichick, N., and Topping, D.J., 2010, Comparison of turbidity to multi-frequency sideways looking acoustic-Doppler data and suspended-sediment data in the Colorado River in Grand Canyon: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Wright, S.A., Topping, D.J., and Williams, C.A., 2010 Discriminating silt-and-clay from suspended-sand in rivers using side looking acoustic profilers: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Wright, S.A., Topping, D.J., Rubin, D.M., and Melis, T.S., 2010. An approach for modeling sediment budgets in supply-limited rivers: Water Resources Research, v. 46, W10538, 18 p., doi:10.1029/2009WR008600.
- 3) Water flow, temperature, specific-conductance, turbidity, and suspended-sediment data were collected, processed and published on either the GCMRC web site or the Arizona Water Science Center web site.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

1. The following peer-reviewed report is awaiting USGS approval. Publication is likely during March-April 2011.
2. Griffiths, R.G., Topping, D.T., Andrews T., Bennett, G.E., Sabol T.A., and Melis, T.S., awaiting USGS approval, Design and maintenance of a network for collecting high-resolution suspended-sediment data at remote locations on rivers, with examples from the Colorado River: U.S. Geological Survey Techniques and Methods Report 2-A__, __p.
3. The following two reports are entering USGS review this winter.
4. Sabol, T.A., Topping, D.J., and Griffiths, R.E., in prep., Field evaluation of intake efficiency and associated sediment-concentration errors in US D-77 bag-type and US D-96-type depth-integrating suspended-sediment samplers: U.S. Geological Survey Scientific Investigations Report 2011-__, XXp.
5. Voichick, N., and Topping, D.J., in prep., Using acoustic, laser-diffraction, and suspended-sediment data to

- extend turbidity data to the full range of conditions in the Colorado River in Grand Canyon: U.S. Geological Survey Scientific Investigations Report 2011-__, XXp.
6. The following report will enter USGS review this spring. A shortened version of this report will also be submitted to the Journal of Geophysical Research.
 7. Topping, D.J., Wright, S.A., Melis, T.S., Rubin, D.M., Sabol, T.A., and Griffiths, R.G., 2010, Calibration and error in suspended-sediment concentration and grain size measured in rivers using multi-frequency acoustics, laser diffraction, and automatic pumps: U.S. Geological Survey Professional Paper __, XX p.
 8. Work will commence and near completion during FY2011 on a web-based tool for computing mass-balance sediment budgets using the data collected by this core-monitoring project for the various monitoring reaches on the Colorado River. This tool will streamline the flow of information on the status of sand and finer sediment to the stakeholders, decision makers, and general public.
 9. 5) All historical Bright Angel Creek and Kanab Creek unit-value stage and discharge data will be posted on the web before the end of FY2011.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Core-monitoring project should continue in current form.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$966,680	FISCAL YEAR NET AVAIL BAL:	\$873,122
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$971,576
END OF FISCAL YEAR AVAILABLE BALANCE:			<\$4,896>

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Underspent suballocations; did more work in house, therefore overspent supplies

SIGNATURE: (Must be /s/ or submitted by PM.)	/s/ Paul Grams	TITLE:	Program Manager	DATE:	12/8/2010
SIGNATURE: (Must be /s/ or submitted by PI.)	/s/ David J. Topping	TITLE:	Principal Investigator	DATE:	12/8/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PHY 7.R1.10: Water Quality Monitoring of Lake Powell and the Glen Canyon Dam Tailwaters	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	William S. Vernieu
E-mail:	bralston@usgs.gov	E-mail	bvernieu@usgs.gov
Telephone:	(928) 556-7455	Telephone:	(928) 556-7051
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>Water-quality of monitoring of Lake Powell and Glen Canyon Dam (GCD) releases. Includes monthly forebay and quarterly reservoir and inflow sampling, monthly tailwater sampling, and continuous tailwater monitoring below Glen Canyon Dam and at Lees Ferry. Coordination with the Bureau of Reclamation (Reclamation) for development, calibration and verification of CE-QUAL-W2 model.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>The Lake Powell Integrated Water Quality Program Interagency Agreement with Reclamation was renewed for FY 2010-2012. This goals of the new agreement are to: 1) analyze existing data and those collected through 2011 from Lake Powell and its tributaries; 2) prepare for, conduct, and report on the 2011 protocol evaluation panel (PEP); and 3) continue to lead the logistics of collecting water quality information in Lake Powell at least through fiscal year 2012, with increased assistance from Reclamation and National Park Service personnel. The budget for the new agreement includes 1.0 FTE for William Vernieu and 0.15 FTE for Dale Robertson data analysis and PEP preparation, conduct, and analysis, including travel and training. Reclamation will provide personnel costs for data collection, including 0.5 FTE for NPS technical support, analytical costs for chemical and biological sample analysis, boat maintenance and fuel, and sampling equipment and supplies</p> <p>An Open-File Report 2010–1159, entitled “Effects of the 2008 High-Flow Experiment on Water Quality in Lake Powell and Glen Canyon Dam Releases, Utah-Arizona”, was published in FY 2010. An Open File report entitled " Water-Temperature Data for Select Nearshore Environments of the Colorado River in Grand Canyon, Arizona during the Low Summer Steady Flow Experiment of 2000" was submitted for final review and publication in FY 2010.</p> <p>In FY 2010, a Seabird oceanographic CTD profiling instrument was purchased to replace the previously used Hydrolab and Eureka profiling systems after extensive evaluations. This system will reduce the amount of field time required to collect water-quality profiles by approximately 75%. FY 2010 also marked the completion of a contract with BSA Environmental, completing the analysis of a seven-year backlog of zooplankton and phytoplankton samples. These results have been incorporated into the Lake Powell database and will be prepared for publication in FY 2011.</p> <p>Monitoring has been ongoing but the frequency of monitoring activities has reduced because of lack of adequate instrumentation during the Seabird procurement process and various boat repairs. Continuous monitoring of GCD releases has been maintained and the remote data acquisition system below Glen Canyon Dam remains functional.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>While there are many science questions addressing the effects of water quality on various resources (sediment, foodbase, fisheries, recreation), no strategic science questions (SSQs) were developed that directly addressed tracking and predicting changes in the water quality in Lake Powell or Glen Canyon Dam releases. SSQs most closely related to the effects of water quality on key resources include SSQ 3-5, SSQ 5-1 and SSQ 5-3. However, there are several existing information needs relating to the quality of water in Lake Powell and Glen Canyon Dam releases.</p> <p>The preparation of a biological Data Series report for Lake Powell and the FY 2009 The publication of Data Series Report DS-471, “Historical Physical and Chemical Data for Water in Lake Powell and from Glen Canyon Dam Releases, Utah-Arizona, 1964–2008”, lay the groundwork for further synthesis of the hydrodynamics of Lake Powell and the evaluation of the effects of hydrology, meteorology, climatology, and dam operations on the quality of water in Lake Powell and Glen Canyon Dam releases. Further collaboration with Bureau of Reclamation model development will aid this synthesis.</p> <p>A Protocol Evaluation Panel review will be conducted in 2011 for the Lake Powell water-quality monitoring program, in conjunction with aquatic foodbase and downstream water-quality studies to ensure the integration of the different programs and their efficacy in meeting the needs of other related strategic science questions.</p>			

Of particular significance to reservoir and release water quality are the effects of climate-induced reservoir drawdown on temperature and dissolved oxygen concentrations in the reservoir water and the potential for this water to be entrained in dam releases, and the fate of advective inflow currents as they move through the reservoir and determine the mixing or stagnation of deep hypolimnetic water near Glen Canyon Dam.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

Open-File Report 2010–1159, entitled “Effects of the 2008 High-Flow Experiment on Water Quality in Lake Powell and Glen Canyon Dam Releases, Utah-Arizona”, was published in FY 2010.

An Open File report entitled " Water-Temperature Data for Select Nearshore Environments of the Colorado River in Grand Canyon, Arizona during the Low Summer Steady Flow Experiment of 2000" was submitted for final review and publication in FY 2010.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

The Open File report, currently in review, entitled " Water-Temperature Data for Select Nearshore Environments of the Colorado River in Grand Canyon, Arizona during the Low Summer Steady Flow Experiment of 2000" will be published, with an expected publication date of March 31, 2011.

A Data Series report describing the recent analysis and compilation of approximately 20 years of biological (chlorophyll, phytoplankton, and zooplankton) data collected on Lake Powell will be developed and ready for review in FY 2011.

Data Series Report DS-471, "Historical Physical and Chemical Data for Water in Lake Powell and from Glen Canyon Dam Releases, Utah-Arizona, 1964–2008" will be updated with data collected during the past two years.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

It is recommended that the Lake Powell program continue, with modifications, under the existing inter-agency agreement with Reclamation. Further modifications may be suggested from Protocol Evaluation Panel recommendations, and analysis of existing data, and collaboration with Reclamation's simulation model development. This evaluation should also include the need for a hydrologic technician, based at GCMRC, to assist with field logistics, data collection and management, and equipment maintenance.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$ 248,896 **	FISCAL YEAR NET AVAIL BAL:	\$210,152
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$175,461
END OF FISCAL YEAR AVAILABLE BALANCE:			\$36,064**

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Project responsibilities and direction were re-evaluated mid-year; originally planned budget was not transferred due to redistribution of participation. Interim funding was transferred to GCMRC several times before SOW was finalized. \$36,064 was unused and will be carried forward to FY11.

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Barbara Ralston	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ William S. Vernieu	TITLE:	Principle Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PHY 7.R2.10: Integrated Flow, Sediment Transport and Temperature Modeling of the CRE	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	Scott Wright, Jon Nelson, Mark Schmeeckle, David Rubin, Peter Wilcock, Kees Sloff, Paul Grams, Josh Korman
E-mail:	<i>pgrams@usgs.gov</i>	E-mail	<i>sawright@usgs.gov</i>
Telephone:	(928) 556-7458	Telephone:	916-278-3024
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
The primary objective of the project is to develop and apply numerical models of sand transport, sandbar evolution, and water temperature dynamics and thereby improve predictive capability of physical system attributes in response to changes in driving variables.			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>Task 1. Complete calibration and documentation of shifting rating curve model (PIs: Wright and Rubin) – The model is complete and published (Wright and others, 2010), see below for complete reference. and the model was applied to predict estimated sand transport for projected WY 2011 releases (Wright and Grams, 2010). The model was also supplied to Bureau of Reclamation Denver Technical Center and training was provided to enable their use of the model in support of the High Flow Environmental Assessment.</p> <p>Task 2. Testing and calibration of existing sand routing models (PI: Wilcock) – A user interface for the existing sand routing model has been developed and documented. Calibration and testing is underway.</p> <p>Task 3. Testing and calibration of eddy scale models (PIs: Nelson, Wright, Rubin, Sloff, Grams) – The goal of this aspect of the project is to develop a predictive capability for building sandbars in eddies. The cooperators (USGS Geomorphology and Sediment Transport Lab) have successfully applied the model to predictions of the three-dimensional flow structure in eddies. The models have not yet performed satisfactorily in predictions of suspended sediment transport and sandbar deposition. Although funding for this portion of the project is ended, the cooperator will continue work on model development with non-AMP funding.</p> <p>Task 4. Bar stability modeling and experiments (PI: Schmeeckle) – Experiments are in progress.</p> <p>Task 5. Modeling applications (Nelson, Wright, Schmeeckle, Grams, Korman) – The shifting rating curve model (see Task 1) was applied to predict estimated sand transport for projected WY 2011 releases (Wright and Grams, 2010). The model was also supplied to Bureau of Reclamation Denver Technical Center and training was provided to enable their use of the model in support of the High Flow Environmental Assessment.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>As detailed in the project proposal, the project addresses the key strategic science question, <i>Is there a “Flow-Only” operation (i.e., a strategy for dam releases, including managing tributary inputs with BHBFs, without sediment augmentation) that will restore and maintain sandbar habitats over decadal timescales? by addressing the following science and management questions:</i></p> <ol style="list-style-type: none"> 1) <u>Science</u>: How do eddy sandbars evolve for a given sediment supply and flow hydrograph, including short duration high flow releases? <u>Management</u>: What is the “optimal” high flow hydrograph (peak and duration) for a given supply condition? 2) <u>Science</u>: How are tributary sediment inputs transported through the mainstem for a given flow hydrograph? <u>Management</u>: How long will tributary sediments be available (and where will they be) for a given operation (i.e. monthly volume, daily peak, daily range)? 3) <u>Science</u>: How does the long-term (i.e. decadal scale) sand budget evolve for a given flow hydrograph and tributary sediment supply (and/or sediment augmentation)? <u>Management</u>: How do different operations compare with respect to long-term sustainability? 4) <u>Science</u>: What controls the slope stability of sandbars that fill and drain on a daily basis due to fluctuating flows? <u>Management</u>: How do various ramping rates affect the stability of sandbars? <p><i>The project also addresses the key strategic science question, regarding mainstem and nearshore temperature by addressing the following science and management question:</i></p>			

5) <u>Science</u> : How does channel complexity and habitat type affect shoreline water temperature distribution and dynamics? <u>Management</u> : Do various fluctuating and steady flow regimes affect shoreline water temperature differently?				
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>				
Logan, B., Nelson, J.M., McDonald, R., and Wright, S.A., 2010, Mechanics and modeling of flow, sediment transport, and morphologic change in riverine lateral separation zones: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada. Wright, S.A., Topping, D.J., Rubin, D.M., and Melis, T.S., 2010. An approach for modeling sediment budgets in supply-limited rivers: Water Resources Research, v. 46, W10538, 18 p., doi:10.1029/2009WR008600. Wright, S.A., and Grams, P.E., 2010, Evaluation of water year 2011 Glen Canyon Dam flow release scenarios on downstream sand storage along the Colorado River in Arizona, U.S. Geological Survey Open-File Report 2010-1133, 19 p. Wright, S.A., Topping, D.J., and Williams, C.A., 2010 Discriminating silt-and-clay from suspended-sand in rivers using side looking acoustic profilers: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.				
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>				
Additional USGS report or journal article on the 3D eddy modeling Journal article describing results of eddy stability modeling.				
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>				
Full funding for this project ended at the end of FY 2010. Funding in FY 2011 supports limited maintenance of existing models.				
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:		\$293,009	FISCAL YEAR NET AVAIL BAL:	\$274,312
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$327,228	
END OF FISCAL YEAR AVAILABLE BALANCE:			<\$34,219>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>				
Underspent suballocations; overspent cooperators due to expanded modeling efforts				
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Paul Grams	TITLE:	Program Manager	DATE: 12/9/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PHY 8.M2.10 Integrated Long-term Monitoring of System Wide Changes in Sediment Storage	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	Rod Parnell, Joe Hazel, Matt Kaplinski
E-mail:	<i>pgrams@usgs.gov</i>	E-mail	<i>Rod.parnell@nau.edu</i>
Telephone:	(928) 556-7458	Telephone:	928-523-3329
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The fundamental objective of this study is to monitor the magnitude and trends in fine sediment storage throughout the Colorado River Ecosystem. Additional goals of this project are to determine magnitudes and trends in sandbar and campsite area and distribution, backwater geometry and distribution, and the availability of open dry sand on sandbars that can be transported by the wind upslope into archeological sites thereby helping preserve these resources.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>In FY 2010 we finalized analysis and reporting on several projects that were related to the 2008 HFE. These products listed in section 6 below.</p> <p>In FY 2010 we completed new field data collection on one research river trip in October 2009. This trip completed topographic, photographic, and campsite area surveys at the long-term sandbar and campsite monitoring sites. The data collected on this trip have been processed and will be presented at the annual reporting meeting.</p> <p>In May 2009, this project completed mapping of the channel from river mile 30 to river mile 61. These data were processed in FY 2010 and will be presented, in draft form, at the annual reporting meeting.</p> <p>The data collected from 2000 to 2004 as part of the "FIST" project have been verified for consistency with the 2009 data and a method for computing uncertainty has been developed and applied. The results from this effort, including preliminary results comparing data collected in 2000-2004 with data collected in 2009 will be presented at the annual reporting meeting. Reporting on these data is approximately one to two months behind schedule owing to prioritization of reporting on the 2008 HFE. These reports will be completed during FY 2011.</p> <p>Data from longitudinal profiles of the bed of the Colorado River between Lees Ferry and Diamond Creek collected in 1965, 1976, 1984, 1995, 1997, 2000, 2002, 2004, 2008, and 2009 were compiled and analyzed to investigate potential long term changes in river bed elevation. A preliminary report will be presented at the annual reporting meeting.</p> <p>Tools for analysis of sandbar and river channel topographic and bathymetric data were developed internally at GCMRC in cooperation with DASA and with cooperators at Utah State University.</p> <p>Other accomplishments include preparation of 2000-2004 topographic/bathymetric ("FIST") data, sandbar monitoring surveys, and sandbar monitoring images for serving on the GCMRC website and finalization of reports listed in section 6, below.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SSQ 4-1. Is there a "Flow-Only" operation (that is, a strategy for dam releases, including managing tributary inputs with BHBFs, without sediment augmentation) that will restore and maintain sandbar habitats over decadal timescales?</p> <p>This monitoring will provide the information that is needed to evaluate the direction and magnitude of trends in fine sediment storage over long (> 5 year) timescales. This information is necessary to determine whether dam operations, including high flows, result in net accumulation, depletion, or conservation of fine sediment in the Colorado River ecosystem. It compliments sediment budget efforts by focusing on <i>where</i> within the ecosystem sand storage is positive, negative, or neutral. Most of the fine sediment is stored at low elevation in eddies and in the channel such that measurement of the storage volume requires bathymetric mapping.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>Draut, A.E., Rubin, D.M., Wright, S.A., and Schmidt, J.C., 2010, Grain-size evolution in suspended sediment and deposits from the 2004 and 2008 high-flow experiments in the Colorado River through Grand Canyon, Arizona: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.</p>			

- Grams, P.E., Hazel, J.E.,** Schmidt, J.C., **Kaplinski, M.,** Wright, S.A., Topping, D.J., and Melis, T.S., 2010a, Geomorphic response of sandbars to the March 2008 high-flow experiment on the Colorado River downstream from Glen Canyon Dam, in Hydrology and sedimentation for a changing future; existing and emerging issues (Joint Federal Interagency Conference 2010--Federal Interagency Hydrologic Modeling, 4th, and Federal Interagency Sedimentation, 9th), Las Vegas, Nev., June 27- July 1, Proceedings: v. ISBN: 978-0-9779007-3-2, CD-ROM.
- Grams, P.E.,** Schmidt, J.C., and Andersen, M.E., 2010b, 2008 High-flow experiment at Glen Canyon Dam--morphologic response of eddy-deposited sandbars and associated aquatic backwater habitats along the Colorado River in Grand Canyon National Park: U.S. Geological Survey Open-File Report 2010-1032, 73 p., accessed on July 27, 2010, at <http://pubs.usgs.gov/of/2010/201032/>.
- Grams, P.E.,** Schmidt, J.C., and **Topping D.J.,** 2010, Bed incision and channel adjustment of the Colorado River in Glen Canyon National Recreation Area downstream from Glen Canyon Dam , in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010–5135.
- Hazel, J.E., Jr., Grams, P.E.,** Schmidt, J.C., and **Kaplinski, M.,** 2010, Sandbar response following the 2008 high-flow experiment on the Colorado River in Marble and Grand Canyons, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5015, 52 p. [<http://pubs.usgs.gov/sir/2010/5015/>].
- Kaplinski, M., Hazel, J.E., Parnell, R.,** Breedlove, M., Kohl, K., Gonzales, M., 2009, Monitoring fine-sediment volume in the Colorado River ecosystem, Arizona: Bathymetric survey techniques, U.S. Geological Survey Open-File Report 2009-1207.
- Kaplinski, M., Hazel, J.E., Jr., and Parnell, R.,** 2010, Colorado River campsite monitoring, 1998–2006, Grand Canyon National Park, Arizona, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 275-284 p., accessed on July 15, 2010, at <http://pubs.usgs.gov/sir/2010/5135/>.
- Korman, J., **Kaplinski, M,** and Melis, T.S., 2010, Effects of high-flow experiments from Glen Canyon Dam on abundance, growth, and survival rates of early life stages of rainbow trout in the Lees Ferry reach of the Colorado River: U.S. Geological Survey Open-File Report 2010–1034, 31 p.
- Melis, T.S., Topping, D.J., **Grams, P.E.,** Rubin, D.M., Wright, S.A., Draut, A.E., Hazel, J.E., Jr., Ralston, B.E., Kennedy, T.A., Rosi-Marshall, Emma, Korman, Josh, Hilwig, K.D., and Schmit, Lara M., 2010, 2008 High-flow experiment at Glen Canyon Dam benefits Colorado River resources in Grand Canyon National Park: U.S. Geological Survey Fact Sheet 2010-3009, 4 p. [<http://pubs.usgs.gov/fs/2010/3009/>].
- Rubin, D.M., Topping, D.J.,** Chezar, H., **Hazel, J.E.,** Schmidt, J.C., Breedlove, M., Melis, T.S., and **Grams, P.E.,** 2010, 20,000 grain-size observations from the bed of the Colorado River and implications for sediment transport through Grand Canyon, in Hydrology and sedimentation for a changing future; existing and emerging issues (Joint Federal Interagency Conference 2010—Federal Interagency Hydrologic Modeling, 4th, and Federal Interagency Sedimentation, 9th), Las Vegas, Nev., June 27- July 1, Proceedings: v. ISBN: 978-0-9779007-3-2, CD-ROM.
- Tusso, R., Rubin, D.M., Topping, D.J.,** Chezar, H., and Breedlove B., 2010, Using changes in bed-surface grain size as a proxy for changes in bed sand storage, Colorado River, Grand Canyon, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18–20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010–5135, p. 347-355.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

- Hazel, J.E., Jr., Kaplinski, M., Schott, N., Parnell, R., Grams, P., and Ross, R., in progress, Sand Storage Measured at Selected Sites in Colorado River in Marble and Grand Canyons, Arizona, 1990-2009: U.S. Geological Survey Scientific Investigations Report 20xx-xxxx, xx p.
- Kaplinski, M., Grams, P., Hazel, J.E., Gushue, T., Tusso, R., Kohl, K., Shott, N., in progress, Monitoring Fine-Sediment Volume in the Colorado River Ecosystem, Arizona: Construction and Analysis of Digital Elevation Models, U.S. Geological Survey Scientific Investigations Report.
- Kilham, N. and others, Analysis of longitudinal profiles of the bed of the Colorado River in Grand Canyon: 1965 – 2009, report or journal article.
- Parnell, R., Kaplinski, M., Hazel, J.E., Jr., and Schott, N., in progress, Campsite Area Measurements in Marble and Grand Canyons, 1998-2009: U.S. Geological Survey Data Series Report.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Continuation of monitoring activities associated with possible future High flows. Other recommended future activities include: Assessment of legacy data sets such as topographic surveys of sandbars conducted throughout the 1980's, continued archival and database activities associated with daily camera photography, continued

participation in control network activities, comparison of campsite area mapping with automated aerial photography methods, integration activities associated with vegetation growth (comparison of aerial photography), campsite size, near shore ecology and geomorphic attributes of river corridor, development of 1984 aerial photography. Further analysis of sand bar topographic database.

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$218,069	FISCAL YEAR NET AVAIL BAL:		\$198,296
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$274,405	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$56,335>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Under spent salaries & travel; overspent supplies and cooperators due to expanded scope of work					
SIGNATURE: (Must be signed or submitted by PM.)		/s/ Paul Grams	TITLE:	Program Manager	DATE: 12/9/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PHY 8.M2.10 Integrated Long Term Monitoring of System Wide Changes in Sediment Storage	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	Rod Parnell, Joe Hazel, Matt Kaplinski
E-mail:	<i>pgrams@usgs.gov</i>	E-mail	<i>Rod.parnell@nau.edu</i>
Telephone:	(928) 556-7458	Telephone:	928-523-3329
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The fundamental objective of this study is to monitor the magnitude and trends in fine sediment storage throughout the Colorado River Ecosystem. Additional goals of this project are to determine magnitudes and trends in sandbar and campsite area and distribution, backwater geometry and distribution, and the availability of open dry sand on sandbars that can be transported by the wind upslope into archeological sites thereby helping preserve these resources.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>In FY 2010 we finalized analysis and reporting on several projects that were related to the 2008 HFE. These products listed in section 6 below.</p> <p>In FY 2010 we completed new field data collection on one research river trip in October 2009. This trip completed topographic, photographic, and campsite area surveys at the long-term sandbar and campsite monitoring sites. The data collected on this trip have been processed and will be presented at the annual reporting meeting.</p> <p>In May 2009, this project completed mapping of the channel from river mile 30 to river mile 61. These data were processed in FY 2010 and will be presented, in draft form, at the annual reporting meeting.</p> <p>The data collected from 2000 to 2004 as part of the "FIST" project have been verified for consistency with the 2009 data and a method for computing uncertainty has been developed and applied. The results from this effort, including preliminary results comparing data collected in 2000-2004 with data collected in 2009 will be presented at the annual reporting meeting. Reporting on these data is approximately one to two months behind schedule owing to prioritization of reporting on the 2008 HFE. These reports will be completed during FY 2011.</p> <p>Data from longitudinal profiles of the bed of the Colorado River between Lees Ferry and Diamond Creek collected in 1965, 1976, 1984, 1995, 1997, 2000, 2002, 2004, 2008, and 2009 were compiled and analyzed to investigate potential long term changes in river bed elevation. A preliminary report will be presented at the annual reporting meeting.</p> <p>Tools for analysis of sandbar and river channel topographic and bathymetric data were developed internally at GCMRC in cooperation with DASA and with cooperators at Utah State University.</p> <p>Other accomplishments include preparation of 2000-2004 topographic/bathymetric ("FIST") data, sandbar monitoring surveys, and sandbar monitoring images for serving on the GCMRC website and finalization of reports listed in section 6, below.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>SSQ 4-1. Is there a "Flow-Only" operation (that is, a strategy for dam releases, including managing tributary inputs with BHBFs, without sediment augmentation) that will restore and maintain sandbar habitats over decadal timescales?</p> <p>This monitoring will provide the information that is needed to evaluate the direction and magnitude of trends in fine sediment storage over long (> 5 year) timescales. This information is necessary to determine whether dam operations, including high flows, result in net accumulation, depletion, or conservation of fine sediment in the Colorado River ecosystem. It compliments sediment budget efforts by focusing on <i>where</i> within the ecosystem sand storage is positive, negative, or neutral. Most of the fine sediment is stored at low elevation in eddies and in the channel such that measurement of the storage volume requires bathymetric mapping.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>Draut, A.E., Sondossi, H.A., Dealy, T.P., Hazel, J.E. Jr., Fairley, H.C., and Brown, C.R., 2010, 2009 weather and aeolian sand-transport data from the Colorado River corridor, Grand Canyon, Arizona: U.S. Geological Survey Open-File Report 2010-1166, 98 p. [http://pubs.usgs.gov/of/2010/1166/].</p> <p>Draut, A.E., Hazel, J.E., Jr., Fairley, H.C., and Brown, C.R., 2010a, Aeolian reworking of sandbars from the March</p>			

2008 Glen Canyon Dam high-flow experiment in Grand Canyon, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 325-331 p., accessed on July 15, 2010, at <http://pubs.usgs.gov/sir/2010/5135/>.

Draut, A.E., Rubin, D.M., Wright, S.A., and Schmidt, J.C., 2010, Grain-size evolution in suspended sediment and deposits from the 2004 and 2008 high-flow experiments in the Colorado River through Grand Canyon, Arizona: Proceedings of the Joint Federal Interagency Conference on Sedimentation and Hydrologic Modeling, June 27- July 1, 2010, Riviera Hotel, Las Vegas, Nevada.

Grams, P.E., Hazel, J.E., Schmidt, J.C., **Kaplinski, M.,** Wright, S.A., Topping, D.J., and Melis, T.S., 2010a, Geomorphic response of sandbars to the March 2008 high-flow experiment on the Colorado River downstream from Glen Canyon Dam, in Hydrology and sedimentation for a changing future; existing and emerging issues (Joint Federal Interagency Conference 2010--Federal Interagency Hydrologic Modeling, 4th, and Federal Interagency Sedimentation, 9th), Las Vegas, Nev., June 27- July 1, Proceedings: v. ISBN: 978-0-9779007-3-2, CD-ROM.

Grams, P.E., Schmidt, J.C., and Andersen, M.E., 2010b, 2008 High-flow experiment at Glen Canyon Dam--morphologic response of eddy-deposited sandbars and associated aquatic backwater habitats along the Colorado River in Grand Canyon National Park: U.S. Geological Survey Open-File Report 2010-1032, 73 p., accessed on July 27, 2010, at <http://pubs.usgs.gov/of/2010/201032/>.

Grams, P.E., Schmidt, J.C., and **Topping D.J.,** 2010, Bed incision and channel adjustment of the Colorado River in Glen Canyon National Recreation Area downstream from Glen Canyon Dam , in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18--20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010--5135.

Hazel, J.E., Jr., Grams, P.E., Schmidt, J.C., and **Kaplinski, M.,** 2010, Sandbar response following the 2008 high-flow experiment on the Colorado River in Marble and Grand Canyons, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5015, 52 p. [<http://pubs.usgs.gov/sir/2010/5015/>].

Kaplinski, M., Hazel, J.E., Parnell, R., Breedlove, M., Kohl, K., Gonzales, M., 2009, Monitoring fine-sediment volume in the Colorado River ecosystem, Arizona: Bathymetric survey techniques, U.S. Geological Survey Open-File Report 2009-1207.

Kaplinski, M., Hazel, J.E., Jr., and Parnell, R., 2010, Colorado River campsite monitoring, 1998--2006, Grand Canyon National Park, Arizona, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 275-284 p., accessed on July 15, 2010, at <http://pubs.usgs.gov/sir/2010/5135/>.

Korman, J., **Kaplinski, M.** and Melis, T.S., 2010, Effects of high-flow experiments from Glen Canyon Dam on abundance, growth, and survival rates of early life stages of rainbow trout in the Lees Ferry reach of the Colorado River: U.S. Geological Survey Open-File Report 2010--1034, 31 p.

Melis, T.S., Topping, D.J., **Grams, P.E.,** Rubin, D.M., Wright, S.A., Draut, A.E., Hazel, **J.E., Jr.,** Ralston, B.E., Kennedy, T.A., Rosi-Marshall, Emma, Korman, Josh, Hilwig, K.D., and Schmit, Lara M., 2010, 2008 High-flow experiment at Glen Canyon Dam benefits Colorado River resources in Grand Canyon National Park: U.S. Geological Survey Fact Sheet 2010-3009, 4 p. [<http://pubs.usgs.gov/fs/2010/3009/>].

Rubin, D.M., Topping, D.J., Chezar, H., **Hazel, J.E.,** Schmidt, J.C., Breedlove, M., Melis, T.S., and **Grams, P.E.,** 2010, 20,000 grain-size observations from the bed of the Colorado River and implications for sediment transport through Grand Canyon, in Hydrology and sedimentation for a changing future; existing and emerging issues (Joint Federal Interagency Conference 2010--Federal Interagency Hydrologic Modeling, 4th, and Federal Interagency Sedimentation, 9th), Las Vegas, Nev., June 27- July 1, Proceedings: v. ISBN: 978-0-9779007-3-2, CD-ROM.

Tusso, R., Rubin, D.M., Topping, D.J., Chezar, H., and Breedlove B., 2010, Using changes in bed-surface grain size as a proxy for changes in bed sand storage, Colorado River, Grand Canyon, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18--20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010--5135, p. 347-355.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Hazel, J.E., Jr., Kaplinski, M., Schott, N., Parnell, R., Grams, P., and Ross, R., in progress, Sand Storage Measured at Selected Sites in Colorado River in Marble and Grand Canyons, Arizona, 1990-2009: U.S. Geological Survey Scientific Investigations Report 20xx-xxxx, xx p.

Kaplinski, M., Grams, P., Hazel, J.E., Gushue, T., Tusso, R., Kohl, K., Shott, N., in progress, Monitoring Fine-Sediment Volume in the Colorado River Ecosystem, Arizona: Construction and Analysis of Digital Elevation Models, U.S. Geological Survey Scientific Investigations Report.

Kilham, N. and others, Analysis of longitudinal profiles of the bed of the Colorado River in Grand Canyon: 1965 --

2009, report or journal article.					
Parnell, R., Kaplinski, M., Hazel, J.E., Jr., and Schott, N., in progress, Campsite Area Measurements in Marble and Grand Canyons, 1998-2009: U.S. Geological Survey Data Series Report.					
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>					
Continuation of monitoring activities associated with possible future High flows. Other recommended future activities include: Assessment of legacy data sets such as topographic surveys of sandbars conducted throughout the 1980's, continued archival and database activities associated with daily camera photography, continued participation in control network activities, comparison of campsite area mapping with automated aerial photography methods, integration activities associated with vegetation growth (comparison of aerial photography), campsite size, near shore ecology and geomorphic attributes of river corridor, development of 1984 aerial photography. Further analysis of sand bar topographic database.					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$218,069	FISCAL YEAR NET AVAIL BAL:		\$198,296
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$274,405	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$56,335>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Underspent salaries & travel; overspent supplies and cooperators due to expanded scope of work					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Paul Grams	TITLE:	Program Manager	DATE:	12/9/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		REC 9.R1.10: Sandbar and Campable Area Monitoring	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Helen Fairley	Principal Investigator:	Parnell and others (NAU campsite surveys) and Hamilton and others (for Adopt-A-Beach repeat photography)
E-mail:	<i>hfairley@usgs.gov</i>	E-mail	<i>Rod.parnell@nau.edu</i>
Telephone:	(928) 556-7285	Telephone:	928-523-3329
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
This project uses a combination of total station surveys and repeat photography to measure and document physical and biological changes affecting the size and quality of campsites in the Colorado River ecosystem.			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>In October 2009, we completed campsite area surveys at the long-term sandbar and campsite monitoring sites. The data collected on this trip were processed in FY2010 and will be presented at the annual reporting meeting. (See PHY 8.M2.10 for a summary of other NAU accomplishments related to the campsite survey portion of this project in 2010.) In addition to the campsite surveys, volunteers working on behalf of the Grand Canyon River Guides Adopt-A-Beach program collected repeat photographs and anecdotal records of change from ~40 popular campsites in the CRE.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>This project directly addresses the following question by systematically tracking the amount of campable area at a sample of camps and documenting beach front changes and vegetation encroachment using repeat photography:</p> <p>SSQ 3-9. How do varying flows positively or negatively affect campsite attributes that are important to visitor experience?</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>Two USGS/NAU reports related to the campsite survey component of this project were completed in 2010. One report was included as a chapter in the Proceedings volume from the November 2008 symposium; the other one, focused on sand bar responses to the 2008 HFE, includes a discussion about the effects of the 2008 HFE on campable area:</p> <p>Kaplinski, M., Hazel, J.E., Jr., and Parnell, R., 2010, Colorado River campsite monitoring, 1998–2006, Grand Canyon National Park, Arizona, in Melis, T.S., Hamill, J.F., Bennett, G.E., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, 275-284 p., accessed on July 15, 2010, at http://pubs.usgs.gov/sir/2010/5135/.</p> <p>Hazel, J.E., Jr., Grams, P.E., Schmidt, J.C., and Kaplinski, M., 2010, Sandbar response in Marble and Grand Canyons, Arizona, following the 2008 high-flow experiment on the Colorado River: U.S. Geological Survey Scientific Investigations Report 2010-5015, 52 p., at http://pubs.usgs.gov/sir/2010/5015/ (See pp. 23-28 for discussion of effects to campable area).</p> <p>In addition, the Grand Canyon River Guides completed an unpublished report summarizing 2009 Adopt-A-Beach observations and results:</p> <p>Lauck, P., n.d., Long Term Monitoring of Camping Beaches in Grand Canyon: Summary of results for the Year 2009 with comparisons to Pre-2008 High Flow Experiment. Unpublished report submitted to U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff, Arizona: August 30, 2010.</p>			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<p>Lauck, P., in progress, Long Term Monitoring of Camping Beaches in Grand Canyon: Summary of results for the Year 2010.</p> <p>Parnell, R., Kaplinski, M., Hazel, J.E., Jr., and Schott, N., in progress, Campsite Area Measurements in Marble and Grand Canyons, 1998-2009: U.S. Geological Survey Data Series Report.</p>			

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

These two separate, but closely related campsite monitoring efforts constitute the two longest continually running data series in the AMP and should be continued, preferably on an annual basis.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY10 PLANNED GROSS BUDGET:	\$77,856	FISCAL YEAR NET AVAIL BAL: \$72,200
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:		\$68,410
END OF FISCAL YEAR AVAILABLE BALANCE:		\$9,447

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Reduced support for cooperators due to the focus on completing HFE reporting in FY2010; the underspent balance was applied to survey support for Cultural R&D project.

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Helen Fairley	TITLE:	Program Manager	DATE:	12/2010/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY09 Annual Work Plan)		REC 9.R3.10 Compile Campsite Inventory and GIS Atlas (FY07 – FY09)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Helen Fairley	Principal Investigator:	Helen Fairley
E-mail:	hfairley@usgs.gov	E-mail	hfairley@usgs.gov
Telephone:	928-556-7285	Telephone:	928-556-7285
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p>Since 2007, a comprehensive database of all campsite-related data has been compiled by GCMRC and NPS researchers. These data are now (2010) being organized in a GIS format for future web-based access by the public. During the last several years, inventorying and mapping of campsites has been jointly conducted by NPS and GCMRC, and a total of 506 campsites has been identified (this total includes approximately 300 actively used camps, plus approximately 200 historically-used but no longer used "legacy" campsites.) A Geographic Information System (GIS) of all previously and currently identified campsites in the CRE has now been compiled, which includes numerous photographs and other data from past campsite inventories, as well as information on campsite attributes that are known to be important to visitors (e.g., physical size, estimated size of group that can be reasonably accommodated, frequency of use, amount of open sand versus vegetation, mooring attributes, etc.). This new baseline inventory of camps defines the population of all current and past campsites from which samples can be drawn in the future to characterize systemwide changes. This inventory can also serve as the basis for evaluating recreation impacts to other CRE resources of concern such as archaeological sites.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>In 2010, the GCMRC Socio-Cultural program manager and staff continued to work on refining and updating data for the GIS campsite atlas. This data management required the following:</p> <ul style="list-style-type: none"> • Field checking 102 campsites <ol style="list-style-type: none"> 1) Identifying campsites that had not been previously mapped in the field 2) Identifying campsite boundary discrepancies between NPS and GCMRC data 3) Physically visiting and either verifying or adjusting campsite boundaries as needed 4) Digitizing the field data and updating the GIS • Adding 185 campsite photos to the campsite photo database <ol style="list-style-type: none"> 1) Locating the remaining five photo points of the 1973 Weeden campsite inventory 2) Repeating the photos that the NPS and GCMRC had not been able to locate or replicate in the past 3) Entering all the photos into a photo database 4) Hyperlinking each photo to a campsite polygon <p>The Socio-Cultural Program staff continued to work with DASA staff to ensure a smooth transition from ArcGIS 9.2 to ArcGIS 9.3. We also worked with DASA to ensure our campsite data is in the proper format for use with a newly installed mapping service, ArcGIS Server. To assist DASA with implementation of the new online mapping service, we researched and located sample code that can be used with our service. These codes control the workings and look of the various interactive mapping tools that will be available with the online service (e.g. zoom, view new layers, measure distances, etc.).</p> <p>Shortfall: Although we were not successful in producing an atlas that can be accessed and queried via the internet in FY2010, we continue to make progress towards that goal. (During the first fiscal quarter of FY2011 we were able to create basic mapping service that is available internally at GCMRC.) The inability to complete this project in FY2010 was due to circumstances beyond our control. Specifically, DASA's staff was in the process of updating GCMC's ArcGIS software from version 9.2 to version 9.3. ESRI is phasing out its internet mapping service ArcIMS and replacing it with ArcGIS Server. Anticipating this change, DASA is in the process of learning the new software and making the appropriate IT changes.</p> <p>Campsite Atlas Status Summary:</p> <p>Summary of project accomplishments to date include:</p> <ol style="list-style-type: none"> 1. construction and refinement of a database containing data on 500+ current and legacy campsites 2. located all camps accurately in GIS 3. scanned multiple campsite reports 			

4. compiled and digitized multiple sets of campsites photographs (we now have over 4400 images in the campsite image database)
5. #4 required creating a new database for organizing photographs and storing photographs in Oracle (database was constructed in collaboration with DASA data manager to be suitable for future use in other GCMRC projects)
6. Updated the GIS software to the latest version, which is compatible with ESRI's new mapping service and updated GCMRC's mapping service from Arc IMS to ArcGIS Server
7. Created a basic mapping service using ArcGIS Server that allows users to make basic campsite queries
8. Researched visual Basic code that will be used to display photos and control mapping tools in the online Campsite Atlas

By the end of FY2009, the Socio-Cultural Program staff had compiled all data necessary to serve a proto-type GIS atlas. Since then, we have been continuously updating the campsite data and waiting for DASA staff to assist in building the atlas on the web. However, DASA provides support to the entire GCMRC, and large amounts of their time have been consumed by other GCMRC projects (e.g. the Near Shore Ecology project and Aquatic Food Base projects). In addition, in FY10 DASA lost one of three key staff members - the database manager. Also, the GIS software updates were more involved than originally anticipated and the DASA staff has had to learn a new set of GIS skills needed to operate the new mapping service software.

(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT *(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)*

The data collected and stored in the Campsite Atlas will provide a foundation of historical and current data about campsites to aid in answering the following key strategic science questions:

1. How do varying flows positively or negatively affect campsite attributes that are important to visitor experience?
2. How do varying flows regimes positively or negatively affect group encounter rates, campsite competition, and other social parameters that are known to be important variables of visitor experience?
3. How do dam controlled flows affect visitors' recreational experiences, and what is/are the optimal flows for maintaining a high quality recreational experience in the CRE?

When used in conjunction with aerial imagery from 2002, 2005, and 2009, data in the GIS atlas can be used to detect a variety of changes in campsites. The GIS allows one to calculate changes in the availability and distribution of campsites, the size of campsites and their campable area, and the area of open sand vs. density of vegetation within campsites. Other campsite attributes such as shade and mooring qualities can also be assessed using the atlas. These analyses can be focused on individual camps, camps within designated reaches, or camps throughout the entire river corridor.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

During the developmental stages of the Campsite Atlas project, a working GIS and database have been created. The GIS consists of a geodatabase which contains the following feature classes:

- 1) campsite boundaries (polygon feature class)
- 2) campable area boundaries (polygon feature class)
- 3) Belknap, Steven, and GCMRC mileage systems (point feature classes)
- 4) defined relationships with the following database

The Microsoft Access database contains data entry forms that allow a user to enter data and rename photographs which are linked to the campsite polygons in the geodatabase. This relational database stores campsite attributes, legacy inventory information, campsite photograph information, and campsite documentation information. The current GIS and database can be used to perform the analytical procedures described in section 5 above.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

The online Campsite Atlas is de/s/ to be a continuously updated database which will serve data that pertains to campsites found along the Colorado River within Grand Canyon. The current data in the Campsite Atlas includes: four band aerial imagery, campsite area polygons, campable area polygons, campsite photographs, and published documents pertaining to these campsites. In the future, each of these datasets will be updated as new data becomes available.

In 2010, NPS has used the atlas data to produce a DVD containing individual campsite maps and basic campsite data which they plan to serve to the public in a static form through the GRCA website.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

It is recommended that once the Campsite Atlas has passed an initial trial period, it can be used to serve other GCMRC and NPS datasets that pertain to campsites (such as vegetation studies, shoreline habitat, and sandbar surveys). In addition, in the future, it is possible that the GIS atlas could be expanded to include non-campsite related GCMRC and NPS science data that pertains to the Colorado River corridor in Grand Canyon.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		9/28/2010
FY PLANNED GROSS BUDGET:	\$73,430	FISCAL YEAR NET AVAIL BAL:	\$62,200
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:		\$71,134	
END OF FISCAL YEAR AVAILABLE BALANCE:		\$2,297	

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Underspent logistics due to cancelled river trip; overspent suballocations; remaining balance redirected to cultural R&D project

SIGNATURE: (Must be /s/ or submitted by PM.)	/s/ Helen Fairley	TITLE:	Program Manager	DATE:	12/09/2010
SIGNATURE: (Must be /s/ or submitted by PI.)	/s/ Helen Fairley	TITLE:	Principal Investigator	DATE:	12/09/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY09 Annual Work Plan)</i>		REC 9.R4.10 Compile and Analyze Recreational Safety Data (FY09 – FY11)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Helen Fairley	Principal Investigator:	Dr. Pam Foti
E-mail:	<i>hfairley@usgs.gov</i>	E-mail	<i>Pamela.Foti@nau.edu</i>
Telephone:	928-556-7285	Telephone:	928-523-6196
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>Recreational rafter and angler safety was one of the top issues identified by the American public when the Bureau of Reclamation proposed modifying dam operations in the late 1980s to improve power generation capacity (Lloyd Greiner, personal comm., 2005; Department of the Interior, 1995). This issue continued to be a concern throughout the 1990s, as the environmental impact statement was being completed and new regulations over dam operations were being imposed. The issue continues to be a priority concern of the public and Federal managers whenever changes in dam operations are proposed, particularly in relation to experimental releases. Despite public interest and concern for safety, a comprehensive independent assessment of how dam operations and varying flows affect rafter and angler safety has not been compiled for the GCDAMP to inform future decisions about dam operations. This project will fill a crucial information gap needed to by the GCDAMP to make informed recommendations concerning future dam operations. This project will lay the foundation for future research and monitoring efforts that are de/s/ to address management objectives 9.1 and 9.2. CMIN 9.1.1, as modified and ranked by the GCDAMP Science Planning Group in 2005</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>In FY2009, GCMRC Sociocultural program manager prepared a scope of work, developed a new cooperative agreement with NAU, and initiated the first year of this project. This is planned to be a two year graduate research project resulting in a Master's thesis from NAU Department of Geography and Planning, with a target completion date of summer 2011.</p> <p>In FY2010, the NAU graduate student who has undertaken this work as her thesis topic (Kelly McGill) initiate research and began compiling information for her thesis. To date, she has completed the following:</p> <ol style="list-style-type: none"> 1) Compiled the currently available river recreation safety data from Grand Canyon National Park 2) Researched what other safety-related studies have been conducted in other parts of the US and how other river management agencies across the nation have address safety issues 3) Identified knowledgeable experts in river recreation safety and conducted interviews with them 4) Conducted an informal, voluntary survey of Grand Canyon river guides 5) Met with her thesis committee to outline her proposed thesis and seek input on the final planned product 			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
<p>The primary Strategic Science Question being directly addressed by this project is the following:</p> <p>SSQ 3-10. How can safety and navigability be reliably measured relative to flows?</p> <p>Because safety is an important attribute influencing visitor experience, this project will also provide information relevant for addressing a second SSQ about the effects of flows on the quality of recreational experience in the CRE:</p> <p>SSQ 3-8. What are the drivers for recreational experiences in the CRE, and how important are flows relative to other drivers in shaping recreational experience outcomes?</p>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>To date, Ms. McGill has completed a thesis prospectus, compiled various types of data in excel formats, and produced a rough draft of the introduction to her thesis.</p>			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			

The plan is still the same as last year: to produce a completed Master's thesis by May of 2011. In addition, the student and project PI plan to produce at least one journal article for River Resource Management or a similar journal after the thesis is completed.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

N/A

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		11/27/2009	
FY PLANNED GROSS BUDGET:		\$0		FISCAL YEAR NET AVAIL BAL: N/A	
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:		N/A. This project was identified in the FY2009 work plan and funds were transferred to NAU in FY2009. No additional funds were programmed or expended by GCMRC in FY2010.			
END OF FISCAL YEAR AVAILABLE BALANCE:				\$0	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
SIGNATURE: (Must be /s/ or submitted by PM.)	/s/ Helen Fairley	TITLE:	Program Manager	DATE:	12/09/2010
SIGNATURE: (Must be /s/ or submitted by PI.)	/s/ Pam Foti	TITLE:	Principal Investigator	DATE:	12/09/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		HYD 10.M1.10 Monitor Power Generation and Market Values under Current and Future Dam Operations	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Helen Fairley	Principal Investigator:	Helen Fairley
E-mail:	<i>hfairley@usgs.gov</i>	E-mail	<i>hfairley@usgs.gov</i>
Telephone:	(928) 556-7285	Telephone:	(928) 556-7285
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>Tracking power generation (as impacted by operations for other project purposes), power market rates, necessary power purchases, and Basin Fund cash flow provides the means to assess the impact of changes in GCD operations in relation to the four statutory criteria. Currently, there are no ongoing core-monitoring activities related to goal 10. Although data on GCD hydropower generation and opportunity costs under modified low fluctuating flow (MLFF) operations are currently being gathered by the Bureau of Reclamation (Reclamation) and WAPA as routine agency functions, these data are not readily accessible to the Glen Canyon Dam Adaptive Management Program (GCDAMP). The need for this information in a readily accessible format has been identified as a program need, and this project will help to fill this critical information gap.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>We were unable to make significant progress on the project that was originally planned for 2010 due to various issues encountered by WAPA with accessing the requisite data and making it available to GCMRC and the public via the web. Instead of continuing with this project, the 2010 funding was redirected towards a socioeconomic workshop that was held in Phoenix in December 2009. The funding was used to pay for travel, honorariums, and facilitation for the workshop. This two-and-a-half day workshop reviewed AMP socioeconomic information needs and developed a suite of recommendations for future program directions. The workshop included participation by 30 TWG and AMWG members and associated agency personnel, 7 outside presenters who summarized prior and ongoing socioeconomic studies, 4 nationally respected economists, a professional facilitator and a technical assistant. The workshop received positive reviews from all who attended it. A final socioeconomic report was completed by the panel on February 26, 2010, and was used to inform development of the FY11-12 work plan.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>SSQ 3-3. What are the hydropower replacement costs of the modified low fluctuating flow regime? SSQ 3-4. What are the projected hydropower costs associated with the various alternative flow regimes being discussed for future experimental science (as defined in the next phase experimental design)? SSQ 3-5. How do dam controlled flows affect visitors recreational experiences, and what are the optimal flows for maintaining a high-quality recreational experience in the CRE?</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>Hamilton, J., Hanemann, M., Loomis, J, and Peters, L., n.d., Final report of the GCMRC Socioeconomic Research Review Panel: Report of a workshop held December 2-3, 2009, Phoenix, Arizona. Unpublished report submitted to U.S. Geological Survey, Grand Canyon Monitoring and Research Center, Flagstaff, Arizona, February 26, 2010.</p>			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<p>The TWG Socioeconomic Ad Hoc Group is reviewing the above report and will make recommendations to TWG about implementing its recommendations in spring 2011.</p>			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
<p> </p>			

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$9,475	FISCAL YEAR NET AVAIL BAL:		\$8,000
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$34,315	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$24,840>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Overspent "supplies" portion of budget due unplanned costs associated with hosting and facilitating the Socioeconomics Workshop (invoices from participants fall under 'supplies' category)					
SIGNATURE: (Must be signed or submitted by PM.)		/s/ Helen Fairley	TITLE:	Program Manager	DATE: 12/2010/12

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		CUL 11.R1.10 Research & Development towards Core Monitoring	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Helen Fairley	Principal Investigator:	Helen Fairley, Brian Collins, Amy Draut
E-mail:	<i>hfairley@usgs.gov</i>	E-mail	<i>hfairley@usgs.gov</i>
Telephone:	(928) 556-7285	Telephone:	(928) 556-7285
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The goal of this project is to develop an interrelated suite of objective, quantitative monitoring protocols suitable for the logistically challenging field setting of inner Grand Canyon that can be applied in a routine, systematic manner in future years to determine effects of Glen Canyon Dam operations on archaeological sites and other types of historic properties and cultural resources valued by the American people. The monitoring program is also being designed to: (1) generate data useful for studying the effects of experimental flow and non-flow actions on cultural resources in the Colorado River ecosystem (CRE); (2) provide data suitable for informing and/or building future geomorphic models, and (3) provide data useful for determining future treatment needs at archaeological sites and choosing the most effective treatment methods, regardless of the ultimate cause of the deterioration.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>This project, which was initiated in FY2006, is evaluating various tools and methods for monitoring and quantifying physical changes at archaeological sites linked to dam operations. This R&D project is two years behind schedule as a result of extended delays due to NPS permitting concerns. In 2008-2009, GCMRC was not permitted to evaluate the use of LIDAR technology as a monitoring tool for tracking status and trends at archaeological sites within Grand Canyon National Park (GRCA), and as a result, we were unable to complete Phase I of the project as planned. The only field data we collected during those two years pertained to the weather monitoring component of this project.</p> <p>In January 2010, following extensive discussion between NPS and USGS, Grand Canyon National Park agreed to issue a permit to allow the project to continue. In February, GRCA and GCMRC staff worked together to collaboratively identify 10 sites that would be the focus of 2010 fieldwork, and in April and September 2010, GCMRC staff and cooperators returned to the field and collected lidar and other types of survey data at those sites.</p> <p>In addition, in FY2010 GCMRC continued to maintain 11 weather stations and 14 sand traps, and continued to collect weather data and sand transport information in proximity to archaeological sites to evaluate how high elevation sand supplies (as modified by recent high flow events) interact with weather and riparian vegetation and results in deposition or erosion of sediment at archaeological sites. Also as part of this effort, in August 2010, Dr. Amy Draut participated in a Grand Canyon Youth trip, and with the aid of student volunteers, collected data on vegetation from several locations situated downwind of open sand areas to compare with similar data from areas downwind of more vegetated zones. These data will help us to understand how vegetation influences sand transport rates and how Aeolian processes, in turn affect the types and density of vegetation downwind of open sand deposits.</p> <p>GCMRC planned to conduct two workshops with geomorphologists and tribes in 2010, however, these workshops had to be postponed to FY2011 due to multiple competing priorities in the GCDAMP, including the need to complete an HFE synthesis in advance of completing an EA for a future high flow protocol and the need to hold numerous unplanned meetings to discuss and try to resolve tribal concerns about a proposed non native fish removal project. The geomorphological workshop and tribal monitoring workshop are now planned for spring 2011.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO THE KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Two strategic science questions are being directly addressed by this project:</p> <p>SSQ 2-1: <i>Do dam-controlled flows affect (increase or decrease) rates of erosion and vegetation growth at archaeological sites and TCP sites, and if so, how?</i></p> <p>In FY2010, we continued to make progress towards answering this question. The work of Draut and others demonstrates that river-deposited sand from the 2008 HFE moved inland from sand bars towards archaeological sites at specific locations in the CRE (where dry sand bars were created upwind of sites and where riparian vegetation did not pose a significant barrier to sediment transport). The work of Collins and others (2009) previously has shown that sand re-deposition by wind can be a significant process at archaeological sites and can offset losses due to gully erosion.</p> <p>SSQ 2-4: <i>How effective are various treatments (e.g., check dams, vegetation management, etc.) in slowing rates of erosion at archaeological sites over the long term?</i></p>			

Although not yet published, in FY2010 Schott and others prepared a report in which repeat surveys of gullies in the Palisades area and another location downstream were compared and analyzed. The analysis suggests that erosion control measures may be at least partially responsible for reduced erosion rates observed in the Palisades gullies; however, there were too many other uncontrolled variables to be certain of this linkage, and the authors recommended undertaking a more formally structured study in the future to analyze this issue in more depth. Previous work by O'Brien and Pederson (2009) for this project indicated that check dams capture sediment during periods of low intensity rainfall, but they are not effective at slowing erosion during high intensity rainfall events and in fact, may cause more damage (erosion) during high intensity run-off events due to flanking and scouring than if check dams were not present. The monitoring protocols being evaluated by this project are being specifically evaluated in terms of their ability to accurately measure locations and volumes of change associated with gullies, whether checked or not, but in addition, the protocols will be able to measure deposition and/or deflation over the site area as a whole.

A third strategic science question that is being addressed by this project is:

SSQ 2-3. *If dam-controlled flows are contributing to (influencing rates of) archaeological site/TCP erosion, what are the optimal flows for minimizing future impacts to historic properties?*

Answering this last question requires the development of robust quantitative monitoring protocols that can directly measure physical changes occurring at archaeological sites on a system-wide basis and can segregate changes that are influenced by dam operations from those that are due primarily to other factors such as visitor use. The monitoring approach that GCMRC is developing through this R&D project will allow us to assess and quantify physical changes in relation to experimental flows as well as in relationship to broader flow regime patterns over the longer term, in keeping with the goals of GCPA and the GCDAMP.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

Two chapters in the published Proceedings of the November 2008 "Coming Together" Science and Resource Management Symposium dealt with various components of the cultural monitoring R&D project: a chapter by Fairley and Sondossi described the theoretical ecosystem framework that guides the entire project, and a chapter by Draut and others summarized findings related to effects of HFE on sediment transport at several of the monitored archaeological sites. Two other reports summarizing data from the weather and sand transport monitoring components of this project were completed in FY2010. A complete list of FY2010 publications and reports from the cultural monitoring R&D project is included below:

Draut, A.E., Hazel, J.E. Jr., Fairley, H.C., and Brown, C.R., 2010, Aeolian reworking of sandbars from the March 2008 Glen Canyon Dam high flow experiment in Grand Canyon, *In* Melis, T.S., Hamill, J.F., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona: U.S. Geological Survey Scientific Investigations Report 2010-5135, p. 325-331.

Draut, A.E., Sondossi, H.A., Hazel, J.E. Jr., Andrews, T.A., Fairley, H.C., Brown, C.R., and Vanaman, K.M., 2009, 2008 weather and aeolian sand-transport data from the Colorado River corridor, Grand Canyon, Arizona: U.S. Geological Survey Open-File Report 2009-1190. [<http://pubs.usgs.gov/of/2009/1190/>].

Draut, A.E., Sondossi, H.A., Dealy, T.P., Hazel, J.E., Jr., Fairley, H.C., and Brown, C.R., 2010, 2009 weather and aeolian sand-transport data from the Colorado River corridor, Grand Canyon, Arizona: U.S. Geological Survey Open-File Report 2010-1166, 98 p. <http://pubs.usgs.gov/of/2010/1166/>.

Fairley, H.C. and Sondossi, H., 2010, Applying an Ecosystem Framework to Evaluate Archaeological Site Condition along the Colorado River in Grand Canyon National Park, Arizona, *In* Melis, T.S., Hamill, J.F., Coggins, L.G., Jr., Grams, P.E., Kennedy, T.A., Kubly, D.M., and Ralston, B.E., eds., Proceedings of the Colorado River Basin Science and Resource Management Symposium, November 18-20, 2008, Scottsdale, Arizona. U.S. Geological Survey Scientific Investigations Report 2010-5135, p. 333-341.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Drafts of three additional reports were completed in FY2010 and will be forthcoming from this project in the near future. In early 2011, a report on the virtual shoreline GIS analysis conducted by Sondossi and Fairley in 2009 will be published as an USGS Open-File Report (OFR). Another forthcoming OFR by Schott and others summarizes results of repeated surveys of gullies in the Palisades and Furnace Flats area between 1996 and 2010, while the third OFR that will be forthcoming in early 2011 analyzes precipitation values in Grand Canyon and relates them historical episodes of gully erosion:

Sondossi, H.A. and Fairley, H.C., _____, An Analysis of Potential for Glen Canyon Dam Releases to Inundate 242 Cultural Sites in Grand Canyon National Park, Arizona: U.S. Geological Survey Open-File Report 2011-XXXX

Schott, N. D., Hazel, J.E., Fairley, H.C., Kaplinski, M., and Parnell, R.A., _____, Gully Monitoring in Grand Canyon National Park, Arizona, 1996 to 2010, with Emphasis on the March 2008 High Flow Experiment: U.S. Geological Survey Open-File Report 2011-XXXX.

Hereford, R., Bennett, G.E., and Fairley, H.C., _____, Precipitation Variability of the Grand Canyon Region, 1893 to

<p>2009, and Its Effects on Gullyng of Holocene Terraces and Associated Archaeological Sites in Grand Canyon: U.S. Geological Survey Open-File Report 20XX-XXXX.</p> <p>Other publications planned for later in 2011 include a report on the 2010 field (lidar) work, a journal article summarizing results of the geomorphic assessment led by Pederson and Obrien in 2006-2007, and a synthesis of Phase I results.</p>			
<p>(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i></p>			
<p>If sediment conditions are appropriate in spring 2011, DOI is contemplating running a HFE, subject to completion of the NEPA compliance process. Given the likelihood that multiple HFEs will occur in the near future, we request that NPS permit Phase II of this project (the pilot monitoring program) as early in 2011 as possible, so that we can start to collect data from a random sample of sites early in the year and not miss again (as we did in 2008) the opportunity to collect robust baseline monitoring data in advance of the next round of HFEs. This will likely necessitate issuing a permit for Phase II work prior to GCMRC publishing all results from Phase I. GCMRC plans to hold a workshop early in 2011 to update AMP stakeholders about the Phase I results prior to completing all planned publications from this work,</p>			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	
FY10 PLANNED GROSS BUDGET:	\$369,090	FISCAL YEAR NET AVAIL BAL:	\$335,000
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:		\$476,625	
END OF FISCAL YEAR AVAILABLE BALANCE:		<\$107,535>	
<p>COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i></p>			
<p>WCF contribution for publishing was not planned but was necessary due to the number of current and planned publications. GCMRC staff salary was under spent due to a lapsed position (Sondossi); these funds were redirected to the sub-allocation portion of the budget, which was overspent due to need to cover additional unplanned salaries for field and lab work (Note: when originally planned, USGS base funding was available to cover part of the lidar staff salaries for this project, but due to the extensive delays over the permitting issue, the formerly available base salary was redirected to other projects. Once the permitting issues were finally worked out and the cultural project was permitted to proceed, it was necessary to hire other personnel to complete the lidar work, whose salaries were not covered by USGS base funds, therefore, these additional salary costs had to be picked up by GCMRC, resulting in significantly larger sub-allocation costs than originally planned)</p>			
SIGNATURE: <i>(Must be signed or submitted by PM.)</i>	/s/ Helen Fairley	TITLE:	Program Manager
		DATE:	12/2010/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		DASA 12.D1.10: Quadrennial and Resource-Specific Remote Sensing Overflight	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Philip A. Davis
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>pdavis@usgs.gov</i>
Telephone:	(928) 556-7378	Telephone:	(928) 556-7084
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)</i>			
<p>A remote sensing data collection mission is conducted quadrennially to provide imagery and elevation data along the Colorado River ecosystem in support of physical, biological and cultural studies. Next planned overflight is May 2013.</p> <p>The airborne data to be collected are multispectral orthorectified images of the CRE. Area and volumetric analysis of these datasets are used to identify and classify elements of interest. Comparison of datasets acquired over time allow for change detection as long as the data continue to be collected. Airborne data is the basis for many of the science questions and research activities conducted in the Grand Canyon. Sandbar habitat change including vegetation encroachment, shoreline location and character at different flow regimes and the distance to cultural sites, backwater existence and changes, and maps used for positioning GCMRC monitoring areas are a few of the applications of airborne data.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>A primary fiscal objective is to reserve sufficient funding to cover mission costs during implementation. No salaries are funded for this project; work performed will be addressed by GIS personnel funded by the GIS general support project (DASA 12.D5) and the Integrated Image Analysis and Change Detection project (DASA 12.D9). Because of the dependent nature of remote sensing and GIS technologies, products described in this project will result from a combination of efforts across multiple DASA projects.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
<p>There May 2009 overflight data were not fully delivered until late the first quarter of FY2010. Before any classification and trend analysis can take place, the delivered data requires further in-house post-processing i.e. 'smear' removal, image calibration, tiling and mosaicking. The post processing began in FY2010 and continues into FY2011.</p>			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<p>In FY2010-FY2011, there will be significant data assessment and processing tasks occurring throughout both years. Final products and reports are planned for FY2012.</p>			
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	9/28/2010
FY PLANNED GROSS BUDGET:	\$188,519	FISCAL YEAR NET AVAIL BAL:	\$188,519
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:			\$188,519
END OF FISCAL YEAR AVAILABLE BALANCE:			\$0

COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Philip A. Davis	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		DASA 12.D2.10 Grand Canyon Integrated Oracle Database Management System	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Paul Alley
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>palley@usgs.gov</i>
Telephone:	(928)556-7378	Telephone:	(928) 556-7529
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP</i>			
<p>The goal of the database management system at the GCMRC is to provide an organized, secure, and readily available electronic repository for all scientific data collected in the ongoing research and monitoring activities of the center. The relational database management system (RDBMS) also serves as the electronic storage foundation of GCMRC's geographic information system (GIS), providing the repository for all aerial photography, survey control, and geographic layers. The program is therefore a vital component of the decision support process and for adaptive management of GCD.</p> <p>This project establishes the electronic repository and tools necessary to analyze and interpret scientific data collected by the center, thereby providing a fundamental support service to GCMRC scientific investigations and decision support processes.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>Activities and Accomplishments – Summary of major tasks in the FY2010 work plan:</p> <p>Throughout 2010, the GCMRC database coordinator worked extensively with Program Managers, project scientists and data stewards, and various cooperating and contracting agencies to extend and integrate database systems for newly collected data, as well as legacy data that have yet to be imported, into the centralized database for error checking, validation, archiving, and ultimately serving on the World Wide Web. Of particular note are several new data entry applications developed by the DASA Database Coordinator during 2010 which contain real-time error checking and validation routines, easy exports for entry into the DASA Data Acquisition and Management System (DAMS), and the ability to enter data remotely, or with a direct connection to the GCMRC database management system. These new data entry applications will reduce the number of transcription and data entry errors in the GCMRC database, and streamline the data entry process for project data stewards and scientists.</p> <ol style="list-style-type: none"> GCMRC's automated ADAPS water data retrieval system was re-written from scratch, and is now importing data from Arizona and Utah water science centers on a daily basis and making that data available on the GCMRC website. New data entry program was written for the GCMRC Foodbase program that enables non-technical data stewards and scientists to enter data in a highly usable interface, and define custom analysis functions to be performed after data has been entered. New "mark-recapture" and "occupancy" analysis software was written in collaboration with scientists from GCMRC's "Near Shore Ecology" program that formats NSE data in such a way that it can be ingested by off-the-shelf modeling software. The GCMRC fisheries data entry application was re-written and enhanced for gear-specific usage, enabling faster and more accurate entry of fish sample and specimen data. This application also has an automated "Oracle Import" feature that imports data entered by off-site contractors into the GCMRC fisheries database with a single button click. DASA Data Acquisition and Management System (DAMS) enhanced to further automate of rapid importation, archiving, and serving of new and legacy data using the. By using this constantly evolving system new datasets can be defined, populated, and served in literally minutes or hours, instead of the previous timeline of weeks or months. The DASA DAMS represents a truly revolutionary method of importing, archiving, and serving tabular science data that puts control of the data in the hands of project scientists and data stewards who need little or no database or SQL skills to keep their data updated on the GCMRC website. Due to the ability to rapidly create and deploy datasets using DAMS, the Lake Powell water quality and cultural weather databases were available for query and download on the GCMRC website within one day of DASA receiving the data. The field-based data entry system used by nearshore ecology scientists was enhanced for new field requirements. This VB.net data entry software, running on a ruggedized touch-screen 'slate' computer, allowed scientists to instantly record collected data in an Access database stored on the same computer as the software. Sampling locations for this project were pre-determined based on GIS analysis of shoreline 			

habitat types, and then loaded into the data entry software before the trip launched so that data entry personnel would be 'guided' by an intuitive wizard-style interface and prompted for appropriate data. This integrated GIS approach to data entry marks the first time in GCMRC's history that custom software has been used to enter data using pre-determined georeferenced sampling sites based on remote sensing and manual analysis techniques. Additional features include real-time error checking and validation of user input, automatic data backup to USB flash drives, and serial communications with PIT tag scanners allowing PIT tag values to be recorded in data entry system automatically.

Shortfall - Items *not* completed and identified in FY10 work plan:

- **Database/Software:** Supplement DASA data sync application with additional validation and error checking
 - Explanation of shortfall: Refactoring of the DASA Data Acquisition and Management System (DAMS) is planned for FY11-FY12. Validation and error checking routines written in vb.NET have been tested and deployed for the nearshore ecology project, and are ready for integration into a wider variety of applications, including DAMS.
- **Database/Software:** Stanton Repeat Photography Database
 - Explanation of shortfall: Primary reason for shortfall was due to reprioritization of project; as a result, other duties were assigned and completed throughout FY10. DASA suggested the priority of the Stanton Photography database be delayed to coincide with development of larger photograph database being developed in FY11-12 that will accommodate all GCMRC projects and data.

(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (*Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions*)

RIN 12.1. Develop information that can be used by the TWG, in collaboration with the GCMRC, to establish current and target levels for all resources within the GCDAMP as called for in the GCDAMP strategic plan.

The DASA Database Coordinator worked extensively with various GCMRC researchers and cooperating agencies to query and summarize data for use in published reports and analysis efforts. The following are examples of datasets derived from the GCMRC Oracle database system and summarized for reporting purposes during 2010:

1. Enhanced application to generate "tag history" dataset which summarizes the life history of individual specimens across multiple captures and tags. This tag history dataset is the primary input for the Age Structured Mark Recapture Analysis (ASMR) for Humpback Chub.
2. Further developed Access and Excel macros in VBA to summarize foodbase sample and specimen data, and calculate abundance and biomass values.
3. Developed queries and data subsets which summarize non-native fish abundance in Lee's Ferry and elsewhere.

RIN 12.3.1. As necessary, investigate the most effective methods to integrate and synthesize resource data.

The DASA Database Coordinator worked with staff from the DASA GIS team and GCMRC Physical program to synthesize tabular science data with spatial and physical data as required for various reports and/or analyses. A major milestone was crossed during 2010 when GCMRC fisheries biologists were able to pre-determine sampling locations based on remote sensing habitat analysis, and then use those pre-determined sampling locations to drive a wizard-style data input interface on ruggedized field computers. This integration of GIS and tabular sampling data is a truly revolutionary method of pre-referencing biological sample data with habitat characteristics.

RIN 12.5.4. What is the most effective way to distribute information to our stakeholders and the public in a secure and accessible fashion?

DASA database personnel worked throughout 2010 to continue development and testing the GCMRC Data Acquisition and Management System (DAMS), allowing scientists and data stewards from research and monitoring projects to rapidly create and manage searchable databases. This data management system is unique in its ability to access, manage, and serve virtually any type of tabular science data through a single interface. Once in the system, data can be queried and downloaded from the GCMRC website.

For unique data requests, DASA provides subsets of the GCMRC tabular database using the USGS Enterprise FTP system to distribute data files.

DASA is continually investigating new and more effective methods of distributing data and science information to stakeholders, and is currently assisting the SBSC I.T. team to redevelop the GCMRC website in such a way that data and science information are more easily accessible.

(6.) REPORTS/PRODUCTS COMPLETED: (*Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.*)

- **Database:** Integrated tabular/GIS data query tools. Data entry software developed for nearshore ecology relied

on predetermined sampling locations based on nearshore habitat identification using aerial imagery and minimum sampling unit requirements (both manual and remote sensing techniques employed).

- **Database:** Survey Control Point Database. The DASA Database Coordinator continued working with a student employee from the GCMRC survey department to develop a database for storing and disseminating information about GCMRC's control point network in the Grand Canyon. The Access/VBA database developed in 2009-2010 supports automated uploads of new survey data, and easy queries of existing control points in the network (including error values, survey history, descriptions, photographs, etc.).
- **Software:** DASA data sync application with duplicate record checking/prevention. Duplicate handling was enhanced in the DASA data synchronization application so that duplicate rows for incoming datasets could be determined. Plans to refactor this system and add user-controlled duplicate handling and validation are planned for FY11.
- **Software:** Mark-recapture specimen tag synchronization. The application written by DASA staff in 2008 to generate a "tag history" for use in mark recapture modeling was further enhanced and optimized in 2010 for use in modeling software such as "R".
- **Software:** Enhanced field based electronic data entry systems for nearshore ecology project. The NSE field based data entry system allowed project fisheries scientists to enter data into an Access database through a validating wizard-style form written in VB.net. Included in this software is a VB.net utility for live recording and serial communications with PIT tag scanners, automatic data backup to any attached USB drive, and dynamic data entry options based on configuration Excel file provided by end user or project scientist.
- **Web:** The DASA Database Coordinator developed and deployed a binary file download utility for storing and downloading files associated with tabular data queries on GCMRC website. This system is intended to enhance the rapid identification and download of GCMRC science data in a tabular format by providing supporting files, metadata, and reports on the same web page where data is being queried from the GCMRC tabular database management system.
 - **Database:** Developed VBA macros to perform summary analyses of foodbase drift data. VBA macros were written and incorporated into newly developed foodbase data entry forms which allow data entered in MS Access to be exported to MS Excel for statistical and numerical analysis.
 - **Software:** Redesign, testing, and deployment of all fish data entry forms used by GCMRC and contractors
 - **Software:** Redesign, testing, and deployment of all foodbase data entry forms (drift, benthic, and transported) allowing foodbase staff to work remotely and synchronize data with centralized GCMRC Oracle database using DASA Data Acquisition and Management System (DAMS).
 - **Software:** Enhanced automated Oracle database backup software allowing scheduled database backups during off-peak hours. Oracle databases can be shut down, backed up, and restarted with a single button click, or by adding the backup job to a DASA service scheduling application.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Database modules and Web applications:

- Terrestrial biology – web release
 - Vegetation community composition: zones, species, and quantity
 - Avifauna
 - Invertebrate fauna density
- Kanab ambersnail – web release
 - Census and surveys
- Stanton repeat photography – web release
 - 100-year time span photographs
- Survey control points – to be served through web interface

Applications and software:

- Develop field-based electronic data collection system(s) for wire tags in FY2011

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

The DASA Database Coordinator has the following recommendations for continuing and/or modifying the DASA Database Project:

Like other DASA projects, the Database project should continue to emphasize an 'iterative systems development' approach to providing database and software support wherever possible. While DASA programs and staff are always available for ad hoc support requests, building and continually refining general purpose tools which allow project staff to manage and query their own data should be a high priority of DASA programs. By taking an

iterative systems approach to AMP database needs, the following benefits can be realized:

1. A 'data stewardship' model can be encouraged, where project scientists and data stewards gain control over their data by using custom tools and software developed by DASA staff.
2. Data standards can be systematically implemented by building generalized validation procedures into data entry and data synchronization software
3. Maximum gains are realized from limited DASA resources since generalized data management utilities can be used by multiple projects over time.

Work plans which include software development should accommodate an iterative development process with plans for ongoing application revisions and updates, based on evolving needs of GCMRC projects and scientists. Current format of work plans encourages 'completion' of annual activities, with brand new activities being listed each successive year. This annual 'reset' of project activities is counter to an iterative systems development strategy for achieving database software goals of GCMRC.

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		9/28/2010	
FY PLANNED GROSS BUDGET:		\$163,322	FISCAL YEAR NET AVAIL BAL:		\$137,899
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:				\$178,958	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$15,635>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Overspent cooperators due to need for additional GIS assistance					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Paul Alley	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		DASA 12.D3.10: Library Operations	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Esther Hamilton
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>ehamilton@usgs.gov</i>
Telephone:	(928) 556-7378	Telephone:	(928) 556-7385
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p>The GCMRC library acts as the physical repository for reports and data generated by GCMRC scientists as well as materials related to the Colorado River, Grand Canyon and Adaptive Management. The library has undertaken a project to convert all materials in the library to digital format and make them accessible and searchable on the GCMRC Web site. Having materials available through the Web site will allow multiple users to access data concurrently from remote locations, while protecting unique items from damage or loss. Overflight imagery digitally available for spatial analysis will extend the historical spatial record, allowing change detection throughout the Colorado River ecosystem.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>The library catalogs new materials that come from staff scientists, contractors, and cooperators as well as items related to Grand Canyon, the Colorado River, and Adaptive Management. Library staff provide support to cooperators, contractors, and staff scientists by researching and obtaining current and legacy articles and reports related to science projects. Paper reports are scanned into digital PDF files and then input into the library database on the GCMRC Web site. Analog aerial film and photos using the Vexcel Ultrascan 5000, allowing the digital results to be used for 2-D and 3-D change detection.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>The library database was updated and corrected providing a more accurate reflection of both physical and electronic holdings. Information requests were answered. Paper reports were scanned and added to the library database. Document scanning continues at 600dpi (up from 300dpi) for a more readable PDF. Adobe Acrobat PDF outputs files are using a better optimizer that allows for this greater readability without much increase in file size. Analog aerial images from different overflights were scanned for targeted areas at different resolutions for orthorectification methods verification of long term change. A different methodology for determining optimal scanning parameters examining signal to noise through digital image processing was developed by Phil Davis. The Vexcel Scanner aerial image scanner was recalibrated by the factory representative after a complete R&R that included replacing specialized motors. Scanned images include:</p> <p>River Mile 3: 1984 (film), 1985, 1996 and River Mile 8: 1984 (film), 1985, 1996.</p>			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		9/28/2010	
FY PLANNED GROSS BUDGET:	\$78,562	FISCAL YEAR NET AVAIL BAL:	\$66,333

FISCAL YEAR EXPENDITURES/ OBLIGATIONS:		\$82,653			
END OF FISCAL YEAR AVAILABLE BALANCE:		<\$4,091>			
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Overspent supplies due to digital scanner repairs					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/18/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Esther Hamilton	TITLE:	Principal Investigator	DATE:	12/18/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY09 Annual Work Plan)		DASA 12.D5.10: GIS General Support for Integrated Analyses and Projects	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Thomas Gushue
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>tgushue@usgs.gov</i>
Telephone:	(928) 556-7378	Telephone:	(928) 556-7370
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The traditional role of the GIS Program is inherently service-oriented, providing spatial database development, programming and analysis support to the science programs and their cooperators on both a planned and an as-needed basis. The main objective of GIS general support is to provide GCMRC staff, contractors and managers with reliable, accurate spatial data that assists other GCMRC projects with their goals and objectives. It includes the maintenance and support of GIS and remote sensing software required to develop data sets, perform analyses and create useful outputs used by other projects. General support also encompasses the access of spatial data via the World Wide Web in the form of internet mapping services that are developed for both focused scientific efforts and the public alike.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>Work performed by GIS personnel for physical, biological and cultural resource projects include but are not limited to the following: Data entry and GIS database development, analysis of new and existing spatial data, map and graphic generation for field collection, presentation and publication purposes. This project also manages GCMRC's web mapping capabilities, provides support for operation of GIS and remote sensing software applications, serves as a technical lead in the realm of spatial data collection, analysis, preparation and metadata development as these concepts apply to other projects, and works closely with other DASA projects to mold a cohesive data management team.</p> <p>In FY2010, there was a large effort by GIS staff to support remote sensing post-processing work of the May 2009 overflight. This work included developing processes for handling data in initial phases of the image classification work described in the Integrated Image Analysis project. Additional work included providing data needed for use in remote sensing process steps, training staff in proper operation of remote sensing software, and taking a lead on image processing techniques for manipulating data and extracting features such as water from the images.</p> <p>New versions of the ESRI ArcGIS software suite (v9.3) were installed across all systems in FY2010 as well as an additional service pack (1) and several add-on software tools that improve performance and functionality of how GCMRC uses the GIS technology. Included in this work was the development of a deployment strategy for installing, configuring and building map services using ESRI ArcGIS Server software.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>As a key component of Goal 12, the GIS program continued its commitment to support on-going core monitoring and experimental research projects for GCMRC.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<p>The GIS program has developed a library of processing scripts for providing increased spatial analysis capabilities to GCMRC projects. This is best illustrated by the amount of GIS processing taking place in the Physical program, where GIS models and scripts have greatly improved the efficiency in which data are analyzed.</p> <p>Continued effort was put forth to develop new GIS layers for the Near-Shore Ecology project, including sampling locations reaches and sites, and fish sonic tag positioning data – additional analytical techniques applied to NSE pilot data with data integration as a core application in GIS. This involved working in conjunction with staff aquatic biologists and developing custom overlay and analysis techniques for integrating both physical and biological components into a single, consistent sampling regime.</p> <p>GIS support for core monitoring projects continued in FY2010 by providing assistance to LCR HBC Monitoring, Campsite Monitoring and Native Fish Monitoring. Numerous digital map outputs were created for peer-reviewed</p>			

publications (~12 maps), as well as several map products created for professional presentations by GCMRC technical staff, scientists and managers.

The GIS program has also developed new methods for sharing base data information, including posting maps used for publication purposes on an internal Microsoft SharePoint site for use by GCMRC staff. Similar map documents will be made available on the GCMRC website in the near future.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

In 2011, the GIS program will continue to expand the GIS Oracle database and move to new versions of both Oracle and ArcGIS software during the year. One major addition will be to incorporate the May 2009 imagery data into the GIS Oracle Database and build web services for making these data viewable on the GCMRC website.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Continue to move forward with programming and Web access activities.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		9/28/2010
FY PLANNED GROSS BUDGET:	\$347,161	FISCAL YEAR NET AVAIL BAL:	\$305,809
FISCAL YEAR EXPENDITURES/ OBLIGATIONS:			\$244,287
END OF FISCAL YEAR AVAILABLE BALANCE:			\$102,875

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Salaries underspent due to unfilled technician position; Cooperators underspent due to time limits on funding

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Thomas Gushue	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		DASA 12.D8.10: Biometrics & General Analysis			
(2.) PRINCIPAL INVESTIGATOR INFORMATION:					
Program Manager	Glenn Bennett	Principal Investigator:	William Persons		
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>wpersons@usgs.gov</i>		
Telephone:	(928) 556-7378	Telephone:	928-556-7323		
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP</i>					
<p>"The overarching objective of this study is to examine how estimates of abundance and uncertainty for HBC would change if monitoring efforts were reduced such that capture probabilities in future years were reduced by as much as 50%." - Steven Martell</p>					
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>					
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>					
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>					
<p>Report: Evaluating the relationship between capture probability and uncertainty in estimates of humpback chub abundance using ASMR - Steven Martell</p> <p>TWG Presentation of report / results.</p>					
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>					
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$162,327	FISCAL YEAR NET AVAIL BAL:		\$137,059
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$23,952	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$138,375	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries & travel underspent due to lapsed statistician position; Supplies overspent due to Dr. Martell's HBC analysis (invoice posts under 'supplies')					
SIGNATURE: <i>(Must be signed or submitted by PM.)</i>	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/16/10

SIGNATURE: (Must be signed or submitted by PI.)	/s/ William Persons	TITLE:	Principal Investigator	DATE:	12/16/10
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		DASA 12.D9.10: Integrated Image Analysis and Change Detection	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Philip A Davis
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>pdavis@usgs.gov</i>
Telephone:	(928) 556-7378	Telephone:	(928) 556-7344
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p>The purpose of this project is to provide coordinated, comprehensive analyses of the remotely sensed data that were to address a diverse set of monitoring and research questions. The primary data sets that will be analyzed consist of the 4-band digital images and a digital surface model (DSM) of elevation of the river corridor between Glen Canyon Dam and Lake Mead.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>The final delivery May 2009 overflight data that passed internal data assessment was received late in the first quarter of FY2010. Before any classification and trend analysis can take place, the delivered data requires further in-house post-processing i.e. 'smear' removal, performing radiometric adjustments that normalize the sensor and environmental factors to produce a corridor-wide, multispectral image mosaic with consistent surface reflectance. Additionally, inter-flight-line calibrations were used to compare surface elements within overlapping portions of different flight lines and then applied to create seamless mosaics of the image data. Inclement weather resulted in numerous reflights to reduce cloud shadows, which extended the 5-day mission to 10 days and resulted in an image data set with extreme variations in environmental conditions increasing the complexity of producing a consistent, calibrated, and seamlessly mosaicked dataset. The post processing began in FY2010 and continues into FY2011.</p> <p>In FY2009-FY2010, a large effort was undertaken to review the suite of spatial databases covering 2002 and 2005. Whenever possible, attempts were made to detect errors in the automated classifications and adjust the processing to improve upon the final data sets. This occurred through both editing of automated programs and through some manual editing of resultant data sets in order to achieve the best possible final data. Numerous computer programs used to develop all stages of the classification project were created and subsequently modified during the past year. An extensive error assessment and analysis was conducted of the resultant datasets. The final data represent the first ever of its kind canyon-wide image processing project. The error analysis and associated methods are anticipated to support other spatial succinct random sampling needs for future GCMRC projects. In FY2011 a different approach will be applied to the 2005 vegetation analysis to finalize the dataset prior to publication and dataset release.</p>			
(5.) BRIEF SUMMARY OF KNOWLEDGE RELATED TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		9/28/2010	
FY PLANNED GROSS BUDGET:	\$232.437	FISCAL YEAR NET AVAIL BAL:	\$208.943

FISCAL YEAR EXPENDITURES/ OBLIGATIONS:				\$259,999	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$27,562>	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Equipment overspent due to purchase of ENVI software					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/18/2010
SIGNATURE: (Must be signed or submitted by PI.)	Philip A Davis	TITLE:	Principal Investigator	DATE:	12/18/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: <i>(From Final FY10 Annual Work Plan)</i>		SUP 12.S1.10: Logistic Base Costs	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Carol Fritzingler	Principal Investigator:	Carol Fritzingler
E-mail:	cfritzingler@usgs.gov	E-mail	cfritz@usgs.gov
Telephone:	(928) 556-7207	Telephone:	(928) 556-7207
(3.) STUDY OVERVIEW: <i>(Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)</i>			
<p>The Grand Canyon Monitoring and Research Center (GCMRC) provides complete logistical support for 20 to 40 research, monitoring, and administrative river trips through the Grand Canyon annually. These trips range in length from 7 to 21 days and from 7 to 24 people in size. Trips utilize a variety of motor- and oar-powered boats operated by contracted boat operators. Projects operating in the Glen Canyon reach of the Colorado River (Glen Canyon Dam to Lees Ferry) are supported by a variety of motor-powered boats operated by GCMRC researchers and contracted boat operators. Additionally, research activities on the Little Colorado River and at other locations outside of the Grand Canyon National Park boundaries are supported by helicopter services contracted with Bureau of Reclamation. Ground-based support for other research activities outside of the river corridor is also coordinated with GCMRC with the use of leased vehicles.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: <i>(Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)</i>			
<p>GCMRC logistical support was provided for 11 different projects within the physical, biological, and socioeconomic programs. This entailed providing complete logistical support of 21 river trips launching at Lees Ferry, including 4 river trips for the Pueblo of Zuni, Southern Paiute Consortium, Hualapai and Navajo Tribes and two science trips that were conducted jointly with Grand Canyon Youth. River trips were coordinated and combined as feasible to minimize the number of trips and reduce costs. Logistical support was also provided for research projects in the Glen Canyon and Diamond Creek reaches of the Colorado River for aquatic food base and fisheries projects. Helicopter supported trips were conducted on the Little Colorado River for humpback chub research and translocation projects.</p> <p>Significant improvements were made to the warehouse facilities in 2010. These improvements which include construction of a motor boat loading dock and organization of outdoor and indoor equipment storage vastly improved the efficiency and safety of GCMRC logistics operations.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT <i>(Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)</i>			
n/a			
(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i>			
National Park Service research, collecting, and access (trip) permits were obtained for all projects that were operated within Grand Canyon National Park and Glen Canyon National Recreation Area.			
(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
n/a			
(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i>			
Continue project per FY11 work plan.			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	

FY10 PLANNED GROSS BUDGET:	\$205,797	FISCAL YEAR NET AVAIL BAL:	\$173,762
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:	\$209,414		
END OF FISCAL YEAR AVAILABLE BALANCE:	<\$3,617>		
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>			
Supplies overspent due to building loading & staging area to improve boat loading/unloading process			
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Carol Fritzinger	TITLE:	Program Manager
		DATE:	11/29/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		SUP 12.S2.10 Survey Operations	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	Keith Kohl
E-mail:	<i>pgrams@usgs.gov</i>	E-mail	<i>kkohl@usgs.gov</i>
Telephone:	(928) 556-7458	Telephone:	928-556-7371
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The survey department is responsible for assisting researchers to collect and use field measurements and protocols for scientific investigations to achieve accurate spatial data with realistic error assessments for reliable data analysis and database integration. This responsibility consists of collecting field data, and obtaining, maintaining, and upgrading all survey equipment required to fulfill each Principle Investigator's needs. The department also maintains all necessary equipment required for field operations including data collection of single beam and multi-beam bathymetry, topography, laser scanning, and high accuracy control.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>The survey department supported acquisition and analysis of CRE-wide remote sensing data, and collected spatial measurements required for backwater habitat analysis; channel mapping, terrestrial Lidar for cultural program, campsite availability and terrestrial topography. The National Spatial Reference System was advanced in the Grand Canyon region by "blue-booking" GPS data for six additional stations (see http://www.ngs.noaa.gov/FGCS/BlueBook/). Readjustments to the subsequent layers of the control network were required and have been completed. Stage discharge relations and vertical datum positions were determined for numerous sites along the CRE for inundation studies related to near shore ecology. Additionally, the control point database is current through October 2010 data collection and includes station information for the entire network. The department also oversaw contracts for field data collection and spatial data analysis. The department also organized the reestablishment and leveling of a destroyed height modernization and first-order level benchmark. The department also procured Bernese GPS/GNSS vector processing software to better document processing algorithms and increase assurance of results.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Spatial data provide the foundation for managing the Grand Canyon as a physical and cultural resource. Knowledge about the quality of the spatial data is an important component in understanding the appropriate use of the data for scientific research and making sound management decisions. The issue of spatial data accuracy presents itself in the following key strategic science questions: 1-7; maintaining habitat, 2-1,2,&4; erosion rates, 3-9; campsite area, 4-1,2; restore and maintaining habitat, and to support accurate modeling.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<ol style="list-style-type: none"> 1) Protiva, F.R., Ralston, B.E., Stone, D.M., Kohl, K.A., Yard, M.D., and Haden, G.A., 2010, Effects of Glen Canyon Dam discharges on water velocity and temperatures at the confluence of the Colorado and Little Colorado Rivers and implications for habitat for young-of-year humpback chub (<i>Gila cypha</i>): U.S. Geological Survey Open-File Report 2010-1137, 24 p. 2) Kaplinski, M., Hazel, J.E., Jr., Parnell, R., Breedlove, M.J., Kohl, K., and Gonzales, M.F., 2009, Monitoring fine-sediment volume in the Colorado River ecosystem, Arizona—bathymetric survey techniques: U.S. Geological Survey Open-File Report 2009-1207, 33 p., http://pubs.usgs.gov/of/2009/1207/ 3) Grams and others—2008 High-Flow Experiment at Glen Canyon Dam: Morphologic Response of Eddy-Deposited Sandbars and Associated Aquatic Backwater Habitats along the Colorado River in Grand Canyon National Park—Open-File Report 2010-1032. 4) GCMRC Control Point Database- 2010. Database with control point information including adjusted coordinates, station errors, monument type and site photos is available to contractors and cooperators by request. 			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			

The Survey department will support the maintenance and sharing of the control point database.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	09/28/2010
FY10 PLANNED GROSS BUDGET:	\$86,372	FISCAL YEAR NET AVAIL BAL:	\$72,927
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$98,290
END OF FISCAL YEAR AVAILABLE BALANCE:			<\$11,919>

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Equipment overspent due to purchase of cutting edge Bernese software

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Paul Grams	TITLE:	Program Manager	DATE:	12/9/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		SUP 12.S3.10 Control Network	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Paul Grams	Principal Investigator:	Keith Kohl
E-mail:	pgrams@usgs.gov	E-mail	kkohl@usgs.gov
Telephone:	(928) 556-7458	Telephone:	928-556-7371
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>Spatial data referenced to a geodetic control network possesses several advantages over locally defined data. The products with spatial information of natural and cultural features that reference the control network are universally compatible to each other across all sites. The spatial accuracy of the sites with respect to one another is a function of the accuracy of the geodetic control, and this accuracy must be defined. Such compatibility allows users to take multiple spatial products that may have been produced independently for unrelated purposes, and accurately depict the relative positions of features within the datasets. As such, the cross-utilization possibilities for data increase, and new uses and relationships can be made that were not anticipated in the initial data collection. The spatial information generated by such geodetic data ensures that the needs of the organization will be met, and that these products can be subsequently used by secondary and tertiary users. Failure to base spatial information on a geodetic control reference system will cause secondary users to incur substantial additional costs to collect supplemental data in order to utilize the information.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>Geodetic data was collected to support airborne mapping, channel mapping, backwaters studies, sandbar studies, cultural site monitoring, NPS archeological digs, stage discharge relationships and accuracy determination.</p> <ul style="list-style-type: none"> • High -accuracy rim control was added to densify network and reduce vector distances from reference stations to airborne collection platforms. • GPS data was collected at 157 stations along the river corridor river miles 0, 1, 3, 5, 7, 8, 9, 11, 12, 13, 16, 17, 18, 21, 24, 25, 26, 30, 31, 34, 35, 39, 43, 44, 67,71, 71, 73, 74, 77, 104,108,125,and 165- 224 to reduce horizontal and vertical errors within traverses and with amendments to the rim, primary, secondary and tertiary levels of the network. • Readjustments have been made to all levels of the control network hierarchy (e.g. Rim/ NSRS, River Primary, River Secondary, River Tertiary) • The National Spatial Reference System was advanced in the Grand Canyon region by “blue-booking” GPS data for six additional stations (see http://www.ngs.noaa.gov/FGCS/BlueBook/). <p>Final reporting has been delayed due to the addition of field work required for the cultural program and the channel mapping project. The department was required to support two additional collection efforts for terrestrial Lidar mapping of cultural sites. Additionally, the sediment team decided it was in the best interest of the Center to collect the necessary positioning data from National Canyon to Diamond Creek a year earlier than originally planned. The establishment of new control for nearly 60 miles of river (approximately 183 stations) will be included in the planned publication, “Establishing a Spatial Infrastructure for Long Term Monitoring in Grand Canyon, Arizona: The Value of Geodetic Control in Supporting Scientific Research and Resource Management” USGS Scientific Investigations Report. The report deliverable was scheduled for 2010, but has been deferred until 2011 to allow inclusion of the additional control stations. The control point database is current through October 2010 collection efforts and is available to contractors and cooperators upon request.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Spatial data provide the foundation for managing the Grand Canyon as a physical and cultural resource. Knowledge about the quality of the spatial data is an important component in understanding the appropriate use of the data for scientific research and making sound management decisions. The issue of spatial data accuracy presents itself in the following key strategic science questions: 1-7; maintaining habitat, 2-1,2,&4; erosion rates, 3-9; campsite area, 4-1,2; restore and maintaining habitat, and to support accurate modeling.</p>			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			

All required geodetic data has been delivered for backwater analysis, multi beam channel mapping, NPS archeology digs, cultural site monitoring, and aerial mapping. The data was used for the following publications:

Stage-Discharge Relations for the Colorado River in Glen, Marble, and Grand Canyons, Arizona- U.S. Geological Survey Open File Report 2006-1243.

Monitoring Fine-Sediment Volume in the Colorado River Ecosystem, Arizona; Bathymetric Survey Techniques USGS Open File Report

Hazel, J.E., Jr., Grams, P.E., Schmidt, J.C., and Kaplinski, M., 2010, Sandbar response following the 2008 high-flow experiment on the Colorado River in Marble and Grand Canyons: U.S. Geological Survey Scientific Investigations Report 2010-5015, 52 p., <http://pubs.usgs.gov/sir/2010/5015/>

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

- 6) "Establishing a Spatial Infrastructure for Long Term Monitoring in Grand Canyon, Arizona: The Value of Geodetic Control in Supporting Scientific Research and Resource Management" USGS Scientific Investigations Report
- 7) "Grand Canyon Geodetic Control Point Database: Coordinates, descriptions, photographs and survey history" USGS Open File Report
- 8) Report on ground based, terrestrial Lidar applicability and limitations.

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

We recommend that further efforts are made to determine better heights and height systems for hydraulic and hydrographic modeling studies. Present studies and models use change in ellipsoid heights to determine water surface profiles, yet changes in ellipsoid heights do not take into account affects of gravity on heights and hydraulic flow. Additionally, deflections of vertical angles due to gravity anomalies are not yet modeled for water surface profiles. More gravimetric studies are required to better understand these affects.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$176,756	FISCAL YEAR NET AVAIL BAL:	\$151,848
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$170,307
END OF FISCAL YEAR AVAILABLE BALANCE:			\$6,449

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Salaries underspent due to less than expected

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Paul Grams	TITLE:	Program Manager	DATE:	12/9/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		SUP TBD: Tribal River Trips (Refer to SUP 12.S1.10 for write-up)			
(2.) PRINCIPAL INVESTIGATOR INFORMATION:					
Program Manager	Carol Fritzingler	Principal Investigator:	Carol Fritzingler		
E-mail:	cfritzingler@usgs.gov	E-mail	cfritzingler@usgs.gov		
Telephone:	(928) 556-7207	Telephone:	(928) 556-7207		
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)					
Provide logistical support upon request from participating AMP tribes for Grand Canyon river trips.					
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)					
Logistical support was provided for Zuni, Hualapai, Navajo and Southern Paiute consortium. Each of these tribes was provided complete logistics for motor supported trips ranging from 8-15 days with 8 to 25 participants on each trip					
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)					
n/a					
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)					
n/a					
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)					
n/a					
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)					
Continue to provide river trip support to Tribes as requested in 2011.					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:	\$94,324	FISCAL YEAR NET AVAIL BAL:	\$79,641		
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$94,324		
END OF FISCAL YEAR AVAILABLE BALANCE:			\$0		
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Carol Fritzingler	TITLE:	Program Manager	DATE:	11/29/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PLAN 12.P1.10 Enhancing the Grand Canyon Ecosystem Model (GCEM) to Identify Critical Ecosystem Interactions and Data Gaps	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Ted Melis	Principal Investigator:	Carl Walters
E-mail:	<i>tmelis@usgs.gov</i>	E-mail	<i>c.walters@fisheries.ubc.ca</i>
Telephone:	(928) 556-7282	Telephone:	(604) 822-6320
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>There has been a critical need in the GCDAMP to integrate information from food web and fish studies to provide policy advice about impacts of Glen Canyon Dam operations on the aquatic ecosystem in Glen, Marble and Grand Canyons; older models like GCEM have not been able to fill that need. This second phase of ecosystem modeling has four main components: (1) development of Ecopath/Ecosim ecosystem models for the Lees Ferry and LCR confluence reaches of the mainstem, to integrate food base and fish information in relation to changes in water management; (2) stock assessment data analysis and modeling to provide better ecosystem model inputs and validation data for rainbow trout and native suckers; and (3) development of individual-based models for assessment of extinction risk for the humpback chub population in relation to possible catastrophic loss of LCR rearing components; and (4) use of the ecosystem model in stakeholder workshops, as a tool for exploring impacts of alternative dam operations and other non-flow resource management policies (nonnative fish removals, High Flow Experiments (HFE) for beach-building, altered diurnal and seasonal water release patterns, etc).</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>We have developed working Ecopath/Ecosim models for the Lees Ferry and LCR confluence reaches of the mainstem, and have calibrated these models, in so far as possible, using historical data. Model development was done initially by the principal investigator, and was enhanced through two workshops (March and April 2010) involving cooperators from food web (Kennedy, Hall, Rosi-Marshall, Cross and Baxter) and fish projects native and nonnative monitoring & experimental nonnative fish removal (Persons, Makinster, Korman, Yard and Coggins) who provided additional data and critical review of model inputs and predictions. The models fit historical data quite well, and indicate that changes in water supply deliveries (management), particularly changes in annual release schedules and HFEs, have substantially affected food base production and rainbow trout recruitment. High trout recruitments following HFEs in 2008 and 1996, have been a substantial contributor to threats to native fishes near the LCR, apparently driving major changes in predation risk for juvenile native fish. The models predict that sustained high recruitment of trout, with attendant risk for native fish, will continue if HFEs become a regular component of sand-beach management, unless accompanied by continued programs of non-native fish control. A key prediction from the LCR model is that native fish biomass is now near the carrying capacity implied by production of the aquatic food base, so that there will probably not be substantial growth of the humpback chub and sucker populations even if water temperature and predation mortality regimes remain favorable for native fishes.</p> <p>The modeling team carried out two major stock assessment modeling exercises to provide better abundance and trend estimates for fish populations. First, we developed a detailed size-age structured model for rainbow trout, to assist in estimation of historical changes in recruitment and growth rates; this model showed that trout recruitment has responded strongly to two of the three historical HFEs (1996 and 2008), and to drought-related decreases in flow and usable habitat area in the Lees Ferry tailwater reach below the dam. On the basis of 10 years of nonnative fish monitoring data collected below Lees Ferry and 20 years of data from the Lees Ferry reach (recently published by Arizona Game and Fish Department, see Makinster and others, (2010)), outmigration of RBT from the Lees Ferry reach to Marble Canyon can also be estimated from this new model and the model was reviewed by the fishery scientists at a second workshop in October 2010. The RBT model was then used to support a two-part workshop in combination with structured analyses methods to help Reclamation and cooperating stakeholders evaluate a variety of strategies for nonnative fish control (environmental assessment currently underway).</p> <p>Second, we analyzed the PIT tagging data for flannelmouth and bluehead suckers, to provide parameter estimates for bioenergetics (feeding rates, growth, response to temperature changes) and historical recruitments and abundances using the ASMR mark-recapture methodology that is now being used routinely for humpback chub assessment. These assessments show that sucker body growth rates respond strongly to seasonal temperature changes, and there have been major increases in recruitment and abundance since 2000. Flannelmouth sucker recruitment has apparently increased in response to changes in water temperature and reduction in trout predation in the mainstem below the LCR, while bluehead recruitment showed mainly a strong pulse in 2002 (before the temperature increase and predator reduction), apparently in response to favorable rearing conditions in the LCR. Flannelmouth recruitment has remained high, while bluehead recruitment has fallen to near the low levels seen</p>			

during the peak period of trout abundance in the late 1990s.

We have developed individual-based population models (IBM models) for the humpback chub, initially to use in testing for possible biases in the ASMR methodology and later for population viability analysis. These models show that there is virtually no chance of extinction of the LCR chub population due to classical demographic stochasticity, but a substantial risk of extinction if there were a catastrophic event in the LCR that caused near complete mortality of age 1-3 juveniles rearing in the LCR and also high mortality of spawning adult fish (such an event could be caused for example by a springtime vehicle accident causing release of toxic chemicals into the LCR at the Cameron bridge).

(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (*Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions*)

This study addresses four strategic science questions: 1) impact of flow management through dam operations on viability of the rainbow trout population and fishery in the Lees Ferry reach; 2) linkage of fish abundance to the aquatic food base; and 3) factors affecting the viability of the humpback chub population in the LCR; and efficacy of "non-flow" treatments, such removal of brown trout by NPS at BA Creek, and reduction of rainbow trout recruitment to the LCR reach by mechanical removal in Marble Canyon.

(6.) REPORTS/PRODUCTS COMPLETED: (*Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.*)

We have completed two papers for publication in refereed journals:

- 1) a review of the surprising results of GCDAMP and implications of these surprises for the future of the program (USGS review completed, awaiting journal submission)
- 2) A paper describing the bioenergetics and population dynamics analysis of the PIT tagging data for sucker populations (accepted subject to revision, Transactions of the American Fisheries Society)

In addition to these papers, two workshops have been conducted to bring stakeholders and the ecosystem modeling team together to evaluate the ecosystem models and use them for preliminary policy gaming. Ecosystem modeling results have also been presented to AMWG in a talk and PowerPoint show.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

A paper is currently being drafted on the IBM modeling of humpback chub, expected delivery date June 2011.

(8.) RECOMMENDATIONS: (*Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.*)

To be fully effective as a policy evaluation tool, the ecosystem model needs additional development, evaluation, and stakeholder input. As an adaptive management (AEAM) modeling tool, the model should be used as a focus for research integration, discussion, and policy gaming, on a continuing basis. There should continue to be semi-annual modeling workshops like those conducted over the past year at Cedar Key and Saguaro Lake Ranch. These should be a basic and regular part of the food web and fish population monitoring and research programs and reporting, into the foreseeable future.

The most critical data need for future model development and testing is on trends in primary productivity and aquatic invertebrates. Cuts in the food web monitoring program would make it difficult or impossible to validate model predictions about upcoming changes in water management policy, such as HFEs and steady flow tests.

Fish population monitoring programs from Lees Ferry to the LCR reach now appear to be providing adequate information for future modeling, and so do not need major improvements. However, it may be important to evaluate fish population changes downstream of the LCR, particularly in reaches where attempts are being made to reestablish humpback chub populations (Shinumo Creek and perhaps also eventually, Havasu Creek). Current monitoring data for those downstream areas are woefully inadequate. Also, the nearshore ecology (NSE) project has the potential to provide considerable information on recruitment rates of humpback chub and proportions of recruitment arising from mainstem rearing, if it is continued on a routine basis.

On the basis of the 2010 modeling workshops, several suggestions were captured by the modeling team at the end of the most recent October 2010 modeling workshop that stakeholders may consider:

- 1) It would be hugely valuable for informing future policy not to control rainbow trout at the Little Colorado (LCR) in 2011-12. Rationale: We now have two years of reference data from the Nearshore Ecology (NSE) research study showing very high juvenile survival rates of native fish in the mainstem, during a period while trout abundances have been the lowest in decades.
- 2) Our models now predict that the arrival of large numbers of rainbows will NOT result in substantial reduction in survival rates of native fish (as measured by NSE sampling already scheduled), because: (1) turbidity below LCR will reduce rainbow numbers and efficiency; and (2) rainbows have low rates of piscivory due to factors including warm water. This prediction will fail, i.e. survival rates will be lower than in last two years of

<p>NSE, if (1) water is clear (and/or cold) so many rainbows move down and feed below LCR, and (2) predation-competition interactions lead to higher predation rates than predicted.</p> <p>3) Further, a High Flow Experiment (HFE) before summer 2011 might impair our ability to interpret survival estimates (from the NSE project), since it is possible that negative effects of sand filling along rocky shorelines may lead to reduced carrying capacity of these habitats for juvenile humpback chub (HBC). Even if there is a poor survival rate in 2011, long term impacts on the HBC population would not be severe (high proportion of HBC recruits produced in LCR, natural variation in HBC juvenile survival and recruitment, long lived species for which high recruitment variation is "normal").</p>					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$236,564	FISCAL YEAR NET AVAIL BAL:		\$207,454
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$217,940	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$18,624	
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries & travel was only under spent owing to delay in filling biologist position					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Program Manager	DATE:	11/29/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Carl Walters	TITLE:	Principal Investigator	DATE:	11/29/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		PLAN 12.P3.10: Low Steady Summer Flows – Data & Research Compilation, Synopsis & Synthesis	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Barbara Ralston	Principal Investigator:	Barbara Ralston
E-mail:	<i>bralston@usgs.gov</i>	E-mail	<i>bralston@usgs.gov</i>
Telephone:	(928) 556-7455	Telephone:	(928) 556-7455
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
<p>The overall goal of this project is to develop a synthesis of the effects of the 2000 low steady summer flows (LSSF) experiment on the Colorado River ecosystem (CRE) in Grand Canyon. The four phases being employed to achieve the goal are:</p> <ul style="list-style-type: none"> • Phase I. Status of reports/data and synopsis. Identify data and products associated with the 2000 LSSF experiment; synopsise the results of the individual projects (FY2008, draft Open File Report (OFR) June 2008). • Phase II. Data evaluation and identification of secondary analyses. Evaluate individual datasets and provide recommendations for further analysis and/or integration of resource responses to operations (FY2008, workshop August 2008). • Phase III. Synthesis. Use integrated analysis results to develop a synthesis of the effects of the 2000 LSSF Experiment on the CRE (pending recommendations of Phase II workshop) FY2009. • Phase IV. Publication. Publication of secondary analysis in a special volume of a journal or USGS circular or other publishing source FY2009–10. <p>The project outcome is intended to provide managers, and others interested in resource management, with information about how multiple resources respond to a series of flows that varied in duration from several days to several months and in magnitude from 8,000 cubic feet per second (cfs) to 31,000 cfs.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2009 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>A single draft report of all segments was completed for internal review and subsequent external review by July 2010. Anticipate a final report to be completed by Spring 2011. Delays associated with HFE synthesis writing, EA science planning.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>The LSSF experiment was expected to affect and possibly show benefit to multiple resources in the CRE. Similarly, there are multiple SSQs, developed as guidance for GCMRC after the LSSF, that pertain to the flow experiment. The summary project will investigate whether, and to what degree, these SSQs were addressed by the 2000 LSSF experiment. Those SSQs most pertinent to the LSSF experiment are listed below.</p> <p>SSQ 4-1. Is there a “Flow-Only” operation (that is, a strategy for dam releases, including managing tributary inputs with BHBFs, without sediment augmentation) that will restore and maintain sandbar habitats over decadal timescales?</p> <p>SSQ 5-1. How do dam release temperatures, flows (average and fluctuating component), meteorology, canyon orientation and geometry, and reach morphology interact to determine mainstem and nearshore water temperatures throughout the CRE?</p> <p>SSQ 4-2. How important are backwaters and vegetated shoreline habitats to the overall growth and survival of YoY and juvenile native fish? Does the long-term benefit of increasing these habitats outweigh short-term potential costs (displacement and possibly mortality of young humpback chub) associated with high flows?</p> <p>SSQ 1-7. Which tributary and mainstem habitats are most important to native fishes and how can these habitats best be made useable and maintained?</p> <p>SSQ 2-1. Do dam-controlled flows affect (increase or decrease) rates of erosion and vegetation growth at archaeological sites and TCP sites, and if so, how?</p> <p>SSQ 3-9. How do varying flows positively or negatively affect campsite attributes that are important to visitor experience?</p> <p>The document provides discussion and summary of the data reported on by other investigators in a fashion that is intended to convey to managers how water temperatures in backwaters and the mainstem in 2000 may have</p>			

<p>affected YoY native fishes (SSQ5-1, SSq1.7). With respect to recreational/visitor experience the report is intended to convey to managers how discharge volume affect available campable area as well as how time was spent on the river under lower volume conditions. The report also intends to report on how timing and duration of flows affect vegetation response. Questions about sediment augmentation are interwoven into other resource discussions to provide some context of how sediment response may have provided a supporting habitat for fish, vegetation and campers.</p>					
<p>(6.) REPORTS/PRODUCTS COMPLETED: <i>(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)</i></p>					
<p>Presentation on the status of the report and preliminary findings at August AMWG meeting.</p>					
<p>(7.) REPORTS/PRODUCTS PLANNED: <i>(See above, but report those items that are in progress and include expected delivery dates.)</i></p>					
<p>USGS Open-File report Spring 2011.</p>					
<p>(8.) RECOMMENDATIONS: <i>(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)</i></p>					
<p>None</p>					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$16,061	FISCAL YEAR NET AVAIL BAL:		\$13,561
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$15,399	
END OF FISCAL YEAR AVAILABLE BALANCE:				\$662	
<p>COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i></p>					
<p> </p>					
SIGNATURE: (Must be signed or submitted by PM.)		/s/ Barbara Ralston	TITLE:	Program Manager	DATE: 12/8/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A1.10 (A, B, C): Administrative Operations	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis
E-mail:	jhamill@usgs.gov	E-mail	tmelis@usgs.gov
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
Provide budgetary oversight & support to Grand Canyon Monitoring and Research Center (GCMRC), provide vehicles for staff use and provide editorial services to support GCMRC publication process			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
Provided effective administrative support to GCMRC management including personnel recruitment and management, budget tracking and reporting, and contract/agreement support. Funded outreach and publications coordinator and editing assistance positions through Northern Arizona University. Provided scientific technical writing course to scientists for better publication understanding. Participated in two Program Manager retreats to recap accomplishments and refine future goals and needs of GCMRC. Provided reliable transportation for all staff levels.			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
N/A			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the 2010 AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<ol style="list-style-type: none"> 1) FY09 Final Expenditure Report as of November 27,2009 2) Allocation of GCMRC FY09 Carryover, Decreased FY10 CPI and Reduced FY10 Burden Applied to FY10 Budgets 3) GCDAMP Prelim DRAFT FY11 & FY12 Biennial Budget Summary 03-04-10 4) Experimental Funds Projection FY10 - FY12 5) GCDAMP DRAFT FY11 & FY12 Biennial Budget 06-24-10 SUMMARY w GCMRC Recommended Changes 6) FY11-12 Proposed Redirection of AMP Funds 06-11-2010 7) FY10 Mid-Year Update GCMRC Accounts for AMWG 07-20-2010 <budgetary reports to the AMWG and/or the TWG> 			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
End of fiscal year project expenditure recap to the AMWG and the TWG			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
Recommend continuation of this project to effectively support GCMRC management and staff.			
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$253,099	FISCAL YEAR NET AVAIL BAL:	\$218,600
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$310,380
END OF FISCAL YEAR AVAILABLE BALANCE:			<\$57,281>
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)			

Cooperators overspent due to increased workload of Outreach & Publications Coordinator and editing staff

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief	DATE:	12/15/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A2.10: Program Planning & Management	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis
E-mail:	<i>jhamill@usgs.gov</i>	E-mail	<i>tmelis@usgs.gov</i>
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
Provide effective management of the Grand Canyon Monitoring and Research Center (GCMRC) program and provide support for Grand Canyon Dam Adaptive Management Program (GCDAMP), Secretary's Designee, Adaptive Management Work Group (AMWG) and Technical Work Group (TWG) and various ad hoc groups. Funds GCMRC Chief, Deputy Chief, and program management staff. Includes oversight of the Science Advisors' activities.			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the BWP Scope of Work.)			
Provided effective management of GCMRC program; attended and actively participated in all AMWG, TWG and BAHG meetings and conference calls; updated the MRP and SSP to incorporate the provisions of the 5 year experimental plan; prepared draft General Core Monitoring Plan for TWG review and convened GCMP workshop in first quarter of FY10; prepared and revised the FY11-12 BWP; prepared nonnative fish control and fall steady flow experimental plans; responded to numerous requests for information from the Regional Directors and the Secretary's Designee; participated in support of nonnative fish control and high flow experimental protocol environmental assessments as USGS representative cooperating agency, participated in formal and informal tribal consultation;			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
N/A			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
<ol style="list-style-type: none"> 1) FY 09 Annual Project Reports 2) FY2011/12 Biennial Work Plan 3) Revised draft General Core Monitoring Plan (GCMP) 4) Draft Nonnative Fish Control plan 5) Revised and amended SSP and MRP 6) Status of Resource Fact Sheet 7) Humpback Chub population assessment Fact Sheet 8) Revised Fall Steady Flow Plan 			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
<ol style="list-style-type: none"> 1) Finalization of draft reports/plans listed above 2) Annual Reports to TWG for each project December 2010 3) Annual Reports presentation / recap to TWG January 2011 4) Final FY10 Obligations & Expenditure report to TWG / AMWG January 2011 			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
Recommend continuation of this project.			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	

FY10 PLANNED GROSS BUDGET:	\$1,170,148	FISCAL YEAR NET AVAIL BAL:	\$988,000		
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:	\$1,155,183				
END OF FISCAL YEAR AVAILABLE BALANCE:	\$14,964				
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
Salaries under spent due to offset of costs associated with Biology Program Manager					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A3.10: AMWG / TWG Meeting Travel Funds			
(2.) PRINCIPAL INVESTIGATOR INFORMATION:					
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis		
E-mail:	jhamill@usgs.gov	E-mail	tmelis@usgs.gov		
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282		
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)					
Provide travel funds for employees who participate in Adaptive Management Work Group (AMWG) and Technical Work Group (TWG) meetings					
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)					
Attended all AMWG and TWG meetings, plus other related TWG and AMWG ad hoc meetings, such as Desired Future Conditions, etc.					
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)					
N/A					
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)					
N/A					
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)					
N/A					
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)					
Recommend continuation of this project to provide funding for participation in AMWG and TWG meetings					
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010	
FY10 PLANNED GROSS BUDGET:		\$19,068	FISCAL YEAR NET AVAIL BAL:		\$16,100
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:				\$19,445	
END OF FISCAL YEAR AVAILABLE BALANCE:				<\$377>	
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)					
The GCMRC suggests that future annual reporting meetings be convened as TWG meetings to ensure greater participation by all chartered GCDAMP members as means of improving transfer of technical information. Also, it is suggested that more frequent webinars be conducted throughout the year on technical topics as need requires – so as to reduce the number of agenda topics that must be added to the meetings. These have so far been quite popular and effective.					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A4.10 (A): Independent Reviews (not Including Science Advisor & Executive Director)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis
E-mail:	jhamill@usgs.gov	E-mail	tmelis@usgs.gov
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p>To increase the efficiency and quality of the science being developed by the GCMRC and used by the AMWG and the Secretary of the Interior, the GCMRC will establish a peer review process to ensure that all unsolicited, solicited, or in-house proposals and all draft reports received by the GCMRC undergo independent, external peer review. All of GCMRC's scientific activities undergo an independent, external peer review, including all unsolicited, solicited, or in-house proposals. Similarly, all draft reports received by the GCMRC undergo independent external peer review. The peer review protocols developed by the GCMRC meet or exceed the standards articulated by the Secretary of the Interior for DOI agencies.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
N/A			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
N/A			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
N/A			
(7.) REPORTS/PRODUCTS PLANNED: (See above, but report those items that are in progress and include expected delivery dates.)			
N/A			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
<p>Additional funds for final PEP reviews on remote sensing should be scheduled and considered for funding the FY11 work plan to review research and development progress toward long-term monitoring of terrestrial and aquatic resources associated with annual to quadrennial remote sensing missions.</p> <p>Peer review for proposals received by the GCMRC in response to an RFP is conducted through a panel process, while peer reviews for unsolicited and in-house proposals, as well as project reports, are conducted through correspondence. In all cases, the reviewers are offered anonymity, and the individual and panel reviews, where applicable, are provided to the principal investigators along with comments from the GCMRC. In addition, the GCMRC conducts PEPs to review and assess GCMRC's projects and methodologies. To date, PEPs have been held for remote sensing, physical, survey control, terrestrial and aquatic, cultural resource, biological, and water-quality programs. No PEPs were planned for FY2010. FY2011 includes PEP reviews for:</p> <ul style="list-style-type: none"> • Aquatic food web (research & development of monitoring protocols) in conjunction with ongoing Lake Powell & Downstream Integrated Quality of Water monitoring (summer 2011) 			
(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$22,144	FISCAL YEAR NET AVAIL BAL:	\$20,300
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$0

END OF FISCAL YEAR AVAILABLE BALANCE:		\$22,144			
COMMENTS: <i>(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)</i>					
No independent reviews were conducted under this project; independent reviews for publications were provided and paid from the Publications Working Capital Fund					
SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (<i>From Final FY10 Annual Work Plan</i>)		ADM 12.A4.10 (B): Executive Director of Science Advisors Review & Coordination	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis
E-mail:	<i>jhamill@usgs.gov</i>	E-mail	<i>tmelis@usgs.gov</i>
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (<i>Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP</i>)			
<p>The Science Advisors (SAs) contribute to the overall science needs of the GCDAMP as one of the Independent Review Panels (IRPs). They serve special functions not provided by other IRPs. SAs service is enlisted to increase the efficiency and quality of the science and management being developed by the Grand Canyon Monitoring and Research Center (GCMRC) and used by the Adaptive Management Work Group (AMWG) and the Secretary. SAs provide independent scientific oversight and technical advice to insure that GCMRC science programs are efficient, unbiased, objective, and scientifically sound. The SAs are comprised of six to eight interdisciplinary senior scientists, primarily from universities supporting extensive research and provide review of scientific and technical planning documents of GCMRC, Technical Working Group (TWG), and AMWG, including multiyear and annual strategic and operational plans, budgets, and special projects, i.e., Environmental Impact Statement, High Flow Experiment, Low Summer Steady Flow (LSSF) test synthesis, Humpback Chub Comprehensive Plan (HCCP), etc. They also provide advisory service to GCMRC, AMWG, and TWG regarding adaptive management and long term experimental approaches, general science planning, development of new ecosystem science approaches, and technical projects such as a Temperature Control Device and management actions.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (<i>Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.</i>)			
<p>The SAs provided science document reviews and advisory service and accomplishment in the following areas:</p> <ul style="list-style-type: none"> • Assessment of general core monitoring proposal (proposed resources and time commitments, general approaches) • Review of effectiveness of proposed 2011-12 Science Program and activities. Assessment of integration into the existing Strategic Science Plan and Monitoring and Research Plan • Review of potential effectiveness of proposed 2011 science program budget • Review of GCMRC's Fall Stead Flow Science Plan • Review of 2000 LSSF Synthesis Report • Review Core Monitoring Plan for: <ul style="list-style-type: none"> ○ Aquatic Food web research & Lake Powell and Downstream Quality of Water Monitoring ○ Native and Nonnative Fish Monitoring ○ Camping Beaches Monitoring • Review of overall fisheries science and modeling direction • Review of overall sediment science and modeling direction • Review of TWG/AMWG/GCMRC proposed socioeconomic science RFP/science plan • Review of management/science planning direction regarding HBC translocation and trout abatement • Review of 2008 HFE project reports (projects 1-5) in first quarter of FY2010 • Review of HFE Synthesis report(s) in mid FY2010 • Reported to AMWG on review of adaptive programs that have advanced experimental treatments to management actions (AUG 2010) • Participated in Ecosystem Modeling workshops (March and April 2010) <p>SAs and Executive Coordinator also provided advisory services on science and technical issues as requested by GCD AMP entities the Secretary and approved by GCMRC and recruited several new SA's in FY 2009. Services were provided to GCMRC, TWG, AMWG and the Secretary.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO <u>KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT</u> (<i>Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions</i>)			

The GCDAMP Science Advisors review and advisory service program does not explicitly create new knowledge to address key strategic science questions. It does in its advisory service program respond to specific information needs regarding appropriate science and adaptive management processes. In 2009 it provided advisory service to GCMRC on ecosystem science approaches.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

Prepared a report to AMWG on case studies where experimental treatments have advanced to management actions.

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

Report to TWG on options for using decision support tools to improve TWG effectiveness

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

- Implement more collaborative workshops of AMP entities to improve operational effectiveness,
- Increase Interdisciplinary science program implementation and Integrated resource science study and assessments using Ecosystem science paradigm,
- Utilize assessments of knowledge, improved science synthesis and modeling to clarify best native fish management alternatives for Colorado River ecosystem,
- Focused assessment and science of knowledge and science synthesis to design improved interdisciplinary integrated science and management programs for CRE Native (HBC) and Nonnative fishes.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$213,185	FISCAL YEAR NET AVAIL BAL:	\$180,000
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$213,185
END OF FISCAL YEAR AVAILABLE BALANCE:			\$0

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

Anticipate the need for SAs to provide review of integrated HFE and Nonnative fish control science plans, as well as participate in 2011 Knowledge Assessment workshops, etc. If possible, also designate an appropriate SA as participant in the combined aquatic food web and quality of water PEP review in summer 2011.

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief	DATE:	12/15/2010
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A5.10: GCMRC Component of SBSC System Admin Support	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Program Manager	Glenn Bennett	Principal Investigator:	Jason Westfall
E-mail:	<i>gbennett@usgs.gov</i>	E-mail	<i>jwestfall@usgs.gov</i>
Telephone:	(928) 556-7378	Telephone:	(928) 556-7158
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2009 AWP)			
Provide Information Technology (IT) support to ensure Grand Canyon Monitoring and Research Center (GCMRC) has adequate current and future capacities for data storage, ensure networks comply Federal security standards, and provide public full and easy access to publicly released data via GCMRC web sites.			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<ol style="list-style-type: none"> 1) The Certification, Accreditation, & Security Policy and Procedures performed last fiscal year for Contingency Planning and Disaster Recovery were reviewed and completed through the Plan of Action and Milestones process. Our Plans of Action and Milestones (POA&Ms) are used to identify, assess, prioritize, and monitor the remediation progress of security weaknesses found during the Accreditation and Certification process conducted last fiscal year. To meet the standards required to close a POA&M, a Standard Operating Procedure must be created and submitted. 2) Hardware replacements for systems no longer supported by service contracts for parts were replaced on schedule with minimal if any impact to daily operations. 3) Implementing a new solution for the Helpdesk has greatly enhanced our ability to meet the needs of customers. And the response time has become nearly immediate, greatly enhancing our ability to tackle issues. Users can now submit requests via email and the system automatically creates a ticket for them. Before this was strictly a manual process requiring the user to log in and maintain a separate set of credentials. Once the ticket is created, technicians can use this as a central location to document their efforts and share information regarding the issue. And once remediated, the new system allows us to close a ticket with a resolution and forward that information directly to the user's inbox. Another great advantage of this tool is the Solutions repository. To date 131 solutions have been created. As more customers become aware of this resource and begin to use it, they are empowered to take care of some of their IT issues on their own. For the IT staff this is an invaluable tool to capture the steps one should take to resolve common issues. And while bringing new employees onboard it drastically cuts down training time and the time it takes to transfer this knowledge. These "Solutions" have become a multitude of Standard Operating Procedures that we continue to refine and follow. 4) Uninterruptable Power Supplies have been updated and installed to support our datacenter. Prior to this installation the existing UPS devices were incapable of supporting the existing power load to allow adequate up-time to shutdown servers should power fail. Now the added uptime will allow us to manually bring down our systems gracefully during power failure. This was identified as a major failure in our continuity of operations planning and critical to ensure our servers and infrastructure were protected and managed properly. The new UPS architecture also enables us to remotely control system shutdowns as well as automate shutdowns during off hours. We also have the capability to automatically bring systems back up once power has been restored. Because of the interdependency of our systems, it was necessary to develop a system startup plan to ensure the correct order of bringing up each system was followed. 5) Our continuity of operations planning for data backup and recovery have resulted in zero data losses. We have also been able to incorporate Virtual Machine backups in our backup scheduling. This means that each machine we have virtualized to date is being backed up as a complete system. Should one of these servers fail, we need only to restore it to a previously backed up stable state. In the past, such a failure would result in system downtime. If this system was critical to our infrastructure, multiple services would be down until the system was restored. Depending on the degree of failure, this could result in lost services from hours to days. We have also repurposed old disk arrays to take advantage of Microsoft's shadow-copy features. This shadow-copy storage essentially mirrors all the data on our shared common drives. Now if a user accidentally deletes, loses, or misplaces a file on our network drives, we can retrieve a copy of the file from our shadow-copy storage. This makes data recovery of these files much more expedient and doesn't require us to load tapes to retrieve the file from our backups. 6) Development and implementation of the new GCMRC website. The website is now prepared to enter its Operations and Maintenance phase. Additional capabilities have been demonstrated for the system, 			

including email notification when new publications are approved for release in the system. At each phase of the System Development Life Cycle (SDLC), agile software methods were used to prioritize new work. This is in accordance with the USGS standards regarding software development and system management. Testing was a continuous process throughout our SDLC. The USGS Visual Identity specifications were implemented and applied by following the guidance on the USGS Visual Identity website. As instructed, the site pages were validated against the W3C Web site and HiSoftware AccVerify was used to ensure everything displayed as it should and met all legal requirements (for example, Section 508 compliance). The USGS Web Standards Handbook requires All USGS Web servers and Web sites currently accessible via the Internet or Intranet must be registered and inventoried through the online USGS Web Inventory and Registration System. This registration was performed and because we are utilizing the same domain name- www.gcmrc.gov, and equipment (web server) an inventory already exists for the site and only required updating. USGS Fundamental Science Practices requiring public Web sites and Web pages containing science information were adhered to and the appropriate requirements for review, approval, and release of USGS information products was followed. Final Web site approval was documented in the Information Product Data System (IPDS).

(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (*Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions*)

N/A

(6.) REPORTS/PRODUCTS COMPLETED: (*Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.*)

N/A

(7.) REPORTS/PRODUCTS PLANNED:

(*See above, but report those items that are in progress and include expected delivery dates.*)

FY2010 scheduled hardware replacements will continue in FY2011.

(8.) RECOMMENDATIONS: (*Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.*)

Recommend continuation of this project to provide funding for Information Technology needs and support.

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$258,048	FISCAL YEAR NET AVAIL BAL:	\$218,658
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$334,941
END OF FISCAL YEAR AVAILABLE BALANCE:			<\$76,893>

COMMENTS: (*Discuss anomalies in the budget; expected changes; anticipated carryover; etc.*)

Salaries overspent due to website expansion, development & update; Supplies overspent due to increased memory capacity required for large volume of data storage and independent website development assistance (this expense posts to supplies category)

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Glenn Bennett	TITLE:	Program Manager	DATE:	12/15/2010
SIGNATURE: (Must be signed or submitted by PI.)	/s/ Jason Westfall	TITLE:	Principal Investigator	DATE:	12/15/2010

FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		ADM 12.A6.10: 2008 Colorado River Basin Science & Resource Management Symposium Proceedings (USGS SIR 2010-5135)	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
GCMRC Chief	John Hamill	GCMRC Deputy Chief	Theodore S. Melis
E-mail:	jhamill@usgs.gov	E-mail	tmelis@usgs.gov
Telephone:	(928) 556-7364	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p>Publication of 41 articles from presentations made by scientists and resource managers at the November 2008 CRBS&RMS held in Scottsdale. The USGS Scientific Investigations Report (2010-5135) was requested by GCDAMP stakeholders and other contributing supporters of the symposium as documentation of the meeting. The authors were asked specifically to prepare their articles in a style and language that would be easily accessible to the public and other interested resource managers in other river basins.</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
The proceedings report was completed and published in summer 2010			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
The report covers an assortment of resource related topics tied to Colorado River management related to the four Federal programs.			
(6.) REPORTS/PRODUCTS COMPLETED: (Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)			
USGS SIR 2010-5135 (372 pages) represents about 1/3 of the total presentations made at the 2008 symposium and contains contributions from all four of the Federal programs (Upper Colorado River & San Juan River RIPs, Glen Canyon Dam Adaptive Management Program and Lower Colorado River Multi-Species Conservation Program			
(7.) REPORTS/PRODUCTS PLANNED:			
<i>(See above, but report those items that are in progress and include expected delivery dates.)</i>			
None at this time. A second symposium has been suggested for fall 2012 and presumably another proceeding would be developed and published in association with that meeting.			
(8.) RECOMMENDATIONS: (Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)			
If possible, support similar publications that are accessible to the public and other interested parties when similar meetings are convened in the future.			
(9.) FY2010 BUDGET REPORT		FINANCIAL INFORMATION COLLECTION DATE:	
		09/28/2010	
FY10 PLANNED GROSS BUDGET:	\$60,555	FISCAL YEAR NET AVAIL BAL:	\$51,226
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:		\$60,555	
END OF FISCAL YEAR AVAILABLE BALANCE:		\$0	
COMMENTS: (Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)			
SIGNATURE: (Must be signed or	/s/ Theodore Melis	TITLE:	Deputy Chief
		DATE:	12/15/2010

submitted by PM.)					
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FISCAL YEAR 2010 PROJECT REPORT FOR THE GLEN CANYON DAM ADAPTIVE MANAGEMENT PROGRAM

(1.) PROJECT NUMBER/TITLE: (From Final FY10 Annual Work Plan)		Experimental Study - 7 - Synthesis of HFE Results & Knowledge EXPERIMENTAL REPORTING: USGS Circular Summarizing High Flow Experimental Results below Glen Canyon Dam	
(2.) PRINCIPAL INVESTIGATOR INFORMATION:			
Deputy Chief & Project Manager	Theodore S. Melis	Principal Investigator:	Team of Grand Canyon Monitoring and Research Center science staff and a variety of science cooperators
E-mail:	<i>tmelis@usgs.gov</i>	E-mail	Contact: <i>tmelis@usgs.gov</i>
Telephone:	(928) 556-7282	Telephone:	(928) 556-7282
(3.) STUDY OVERVIEW: (Briefly summarize need for project, study goals, objectives, etc., from Final FY2010 AWP)			
<p><u>Project need:</u> The purpose of this USGS report is to provide a summary of the scientific findings that emerged as the result of three high-flow experiments (HFEs) conducted by the U.S. Department of the Interior at Glen Canyon Dam, Ariz., in March 1996, November 2004, and March 2008; <u>Related objective:</u> Identify, on the basis of summarized HFE results, previous synthesis and modeling research and monitoring, a science-based strategy or “HFE protocol” for triggering future high flow experiments from Glen Canyon Dam – in particular, one that might be implemented within a long term experiment intended to address strategic sediment question(s) and related GCDAMP resource issues (see below)</p>			
(4.) REPORT ON FY2010 ACTIVITIES, ACCOMPLISHMENTS, AND SHORTFALL: (Summarize major tasks in the FY2010 AWP. Describe how each task was/was not met. Summarize initial findings and/or final results. Include a description of any significant deviation from the AWP Scope of Work.)			
<p>A draft USGS circular containing five chapters written by various experts was developed during FY 2010, and during fall 2010 each of the chapters was externally peer reviewed in accordance with USGS Fundamental Science Practice protocols. Center level and policy level reviews continue to occur during fall 2010 (at the time of writing this report), with the final publication proposed for completion by early 2011. In addition, during FY 2010, and in support of developing the HFE draft circular, 24 new reports on the March 2008 HFE were also completed in 2010, with 20 currently available either upon request from the GCMRC or at: www.gcmrc.gov.</p>			
(5.) BRIEF SUMMARY OF THE PROJECT TO KEY STRATEGIC SCIENCE QUESTIONS BEING ADDRESSED BY THE PROJECT (Summarize how this project is addressing the key strategic science questions, what has been learned or remains to be learned relative to the key strategic science questions)			
<p>Many questions have been associated with high flow experiments since planning for the initial test began in the early 1990s. Following, are several questions that the GCMRC recognizes as having been identified in previous GCDAMP approved documents. The authors of the HFE Synthesis circular and staff of the GCMRC suggest that these continue to be considered as planning for future HFEs continues to occur:</p> <ol style="list-style-type: none"> 1) Is there a “Flow Only” operation (that is, a strategy for dam releases, including managing tributary inputs with high flow releases, without sediment augmentation) that will rebuild and maintain sandbar habitats over decadal timescales? <ol style="list-style-type: none"> a. Will multiple high flows conducted over a period of 10 years result in net increases in sandbar area and volume within the Colorado River ecosystem (CRE)? b. With the available sand supply (i.e. tributary inputs) is the approach of using repeated floods to build sandbars sustainable? c. Will multiple high flows conducted over a period of 10 years result in net increases in campable area within the CRE? d. Will multiple high flows conducted over a period of 10 years improve archaeological site condition as reflected in increased sand deposition, increased site stability, and reduction in rates of erosion? 2) How does HFE timing and frequency affect Lees Ferry rainbow trout population dynamics? 3) What factors drive downstream dispersal of rainbow trout from Lees Ferry? 4) What are the direct (for example, displacement) and indirect (for example, increases in rainbow trout) effects of HFEs on Humpback Chub? 5) How does HFE timing and frequency affect woody riparian and marsh vegetation composition? 6) How does riparian vegetation influence sandbar building, campable area, and wind-blown transport of sand? 7) How will multiple high flows conducted over a period of several years affect recreational experience quality in the Colorado River corridor? 			

- 8) What are the direct and indirect costs to hydropower customers from HFEs? Is there a significant difference to hydropower in terms of the value of the power generated during the HFEs and well as the "lost opportunity costs" from HFEs when they occur in the fall vs., when they occur in the spring, all other factors (duration, magnitude, etc.) being equal?
- 9) How do HFEs affect the local and regional recreation-based economy and do those effects change significantly in response to the timing (spring vs. fall) of HFEs?
- 10) Is there a significant difference in the numbers and types of safety-related incidents during HFEs in comparison to other operational regimes, and if so, what are the economic values associated with these safety-related incidents (e.g., costs of equipment damage, NPS rescues, medical expenses, etc.)?

The soon to be completed HFE synthesis report attempts to provide information on several, but certainly not all of the above questions, and is intended to capture previously published information on abiotic and biotic resource responses in a language and format that will be useful to managers and decision makers as planning for future long term experimental designs continue in the near future.

On the basis of publications from sediment researchers that preceded the HFE synthesis, the #1 question (and the related sediment questions in the list above) cannot be answered by results from the 1996, 2004 and 2008 HFEs alone (despite the synthesis of the results from the three isolated flow experiments). However, it is suggested by the authors that this fundamental sediment question might be eventually answered through monitoring of fine sediment resources following repeated HFEs released under tributary sand enriched supply conditions in Marble and Grand Canyon (perhaps over a decade or longer period). The main purpose of the final chapter of the circular is to identify a science strategy for triggering future HFEs from Glen Canyon Dam on the basis of tributary sand inputs from tributaries below the dam, among other resource considerations.

The authors also identify question #2, above, as likely being the most important biological question to address related to repeated HFEs in the future (as it pertains to questions 3 & 4 and the GCDAMP objectives for native fish (particularly, humpback chub) in Grand Canyon National Park). Addressing these three questions can likely be also be accomplished by conducting either spring or fall timed HFEs following tributary sand enrichment from the Paria River and other downstream tributaries and continuing appropriate fishery and food web monitoring and research focused on both rainbow trout and native fish in Glen and Marble Canyons. It is deemed important to coordinate and integrate such biological HFE monitoring with any nonnative fish control experimental treatments.

(6.) REPORTS/PRODUCTS COMPLETED: *(Include all deliverables identified in the AWP that have been completed and report on all products beyond those deliverables identified. Include reports, presentations, poster sessions, exhibits, databases, workshops, maps, website contributions, decision support systems, newsletters, etc.)*

24 separate reports on March 2008 High Flow Experiment (see list below)

(7.) REPORTS/PRODUCTS PLANNED:

(See above, but report those items that are in progress and include expected delivery dates.)

USGS Circular containing five stand-alone, multi-authored chapters + 4-page USGS Fact Sheet – both should be completed in 2nd quarter of FY2011

(8.) RECOMMENDATIONS: *(Describe recommendations for continuation or modification of project, other studies, or activities resulting from findings of this project; recommendations for MRP changes or future program guidance, etc.)*

Upon final publication of the HFE circular, proceed with GCDAMP requested **2011 Knowledge Assessment** using this report on flow experimentation as a general template for summarizing results from other experimental flow and non-flow treatments

(9.) FY2010 BUDGET REPORT	FINANCIAL INFORMATION COLLECTION DATE:		09/28/2010
FY10 PLANNED GROSS BUDGET:	\$170,968**	FISCAL YEAR NET AVAIL BAL:	\$144,628
FISCAL YEAR 2010 EXPENDITURES / OBLIGATIONS:			\$301,279**
END OF FISCAL YEAR AVAILABLE BALANCE:			\$0

COMMENTS: *(Discuss anomalies in the budget; expected changes; anticipated carryover; etc.)*

FY2010 initial budget did not reflect carryover from FY09, however "FY09 Carryover, CPI & Burden Adjustments" document presented at February, 2010 AMWG meeting reflected additional carryover funding. All funds were expended.

SIGNATURE: (Must be signed or submitted by PM.)	/s/ Theodore Melis	TITLE:	Deputy Chief & Project Manager	DATE:	11/29/2010
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