

From	Date	Progress review #	Notes
USBR	27 Nov 1996	1	
USBR	13 Mar 1997	1	Asks USFWS for response to 27 Nov 1996 memo
USFWS	3 Apr 1997	1	Response to 27 Nov 1996 and 13 Mar 1997 memos
USFWS	30 Jun 1997	1	Follow-up to 3 Apr 1997 memo
USBR	12 Dec 1997	2	There was not an official USFWS response
USBR	25 Feb 1999	3	
USFWS	27 May 1999	3	Response to 25 Feb 1999 memo
USBR	8 May 2002	4	
USFWS	13 June 2002	4	Response to 8 May 2002 memo
USBR	5 May 2004	5	pdf title indicates that this is a draft
USBR	7 Sept 2004	5	
USFWS		5	No official USFWS response. A draft has been completed.



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

UC-320
ENV-1.10

NOV 27 1996

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service, 2321 W. Royal Palm Road, Suite 103,
Phoenix AZ 85021-4951

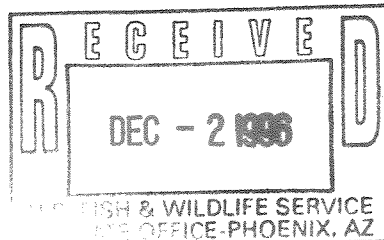
From: Charles A. Calhoun
Regional Director

Subject: Review of Sufficient Progress in Implementation of the Elements of the Reasonable and Prudent Alternative from the December 21, 1994, Biological Opinion on the Operations of Glen Canyon Dam

The Bureau of Reclamation has reviewed the elements of the Reasonable and Prudent Alternative contained in the Glen Canyon Dam Operations Biological Opinion and our progress to date in implementing them. The completed and ongoing activities have been presented to members of the Fish and Wildlife Service's Phoenix office staff. A detailed description of the status of each element is attached for your review. Based on this review we have concluded that progress to date is sufficient.

We intend to continue working diligently to complete the remaining work and will keep you apprised of our progress. Your written view on this conclusion is requested. Although our previously scheduled meeting had to be canceled, we are looking forward to meeting with you in the near future to complete a programmatic review of activities related to the operation of Glen Canyon, including implementation of the RPA.

Should you need further information, contact Christine Karas at (801) 524-3679.



Attachments

cc: Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement
P.O. Box 1306
500 Gold Avenue
Albuquerque NM 87103

Dave Garrett, Grand Canyon Research and Monitoring Center

Progress Review - Implementation of the Glen Canyon Dam Operations Biological Opinion

1 - Adaptive Management Program

Prior to the Secretary of the Interior signing the Record of Decision (ROD) on the Glen Canyon Dam Environmental Impact Statement, Reclamation organized the Transition Work Group (TWG). This group meets regularly, in much the same fashion as the future Adaptive Management Work Group (AMWG) will meet. Steve Magnussen has been named as the Secretary's designee to the TWG. Numerous drafts of the Adaptive Management Workgroup Charter have been circulated for comment, and the final version is currently in Washington D.C. for approval and signature. The ROD was signed on October 9, 1996, formally adopting the preferred alternative, including the AMP and the Grand Canyon Research and Monitoring Center (Center). Activities to staff and house the Center are ongoing.

1A - A Program of Experimental Flows *

The RPA recommends that experimental flows include high steady flows in the spring, and that studies of high steady flows in spring may include habitat building and habitat maintenance flows. A habitat/beach building flow of 45,000 cfs, including appropriate up and down ramps, was conducted in March, 1996. The final reports analyzing the effects of the habitat/beach building flow are due on or before December 31, 1996. Final analysis and integration of the data will require approximately one additional year and should be available in late 1997. Conducting this experimental flow required preparation of an environmental assessment (February, 1996), and a Biological Assessment (November, 1995) for consultation under the Endangered Species Act. Following analysis, a finding of no significant impact was issued. A symposium to discuss the results of the experimental flow is currently scheduled for April 2-3, 1997.

The BO also recommended: "... testing of low steady flows in summer and fall during low water years. Information from final GCES endangered fish reports, researchers who conducted those studies, and other knowledgeable individuals are to be used to develop hypotheses and studies to accompany those flows. Design of the experimental flows and associated studies will begin as soon as possible and be targeted for completion by October 1996". The BO recommended experimental flows be initiated in April, 1997. If sufficient progress and good faith effort is occurring toward initiating experimental flows, implementation of experimental flows may occur later in 1997. If the FWS believes there is not sufficient progress, Glen Canyon Dam would be operated as Seasonal Adjusted Steady Flows during spring through fall (April to October) beginning in 1998.

The Annual Operating Plan for water year 1997, prepared in accordance with the Colorado River Basin Project Act, does not contain requirements to conduct these flows during this water year. This decision is based upon Reclamation forecasting water releases greater than 8.23 maf. Under this release condition, the BO allows implementation of the preferred alternative.

* A copy of the RPA is attached for reference.

Reclamation accepted Fish and Wildlife Service's (FWS) recommended RPA in an April 6, 1995, response to the BO. This letter of response indicated how Reclamation would implement the RPA. In this response, Reclamation articulated that: implementation of experimental flows are to be coordinated through the AMP; the flow experiments will include scientifically based peer reviewed criteria to measure and evaluate their impacts on downstream resources; the research would be managed and administered through the Center; and that appropriate staff and funding levels needed to be identified. Delays in the signing of the ROD have resulted in only partial implementation of the AMP; however, as previously stated, Reclamation has managed to keep these processes moving forward. Dr. Garrett, Center director, has conducted multiple meetings to formulate research needs and is continuing to progress toward a long term research and monitoring plan which will evaluate the flows.

1B - Selective Withdrawal Program for Lake Powell

Funding has been programmed to continue working toward a decision regarding selective withdrawal. Studies of the macro invertebrates below the dam are ongoing, and the final report is scheduled for completion in May, 1997. Studies on chlodophora and gammerous have been completed by Dean Blen. A model which will be used to evaluate the effectiveness of a selective level withdrawal is being set up and calibrated by Reclamation's Denver office. The study will be completed in 1997.

1C - Determine responses of native fish to various temperature regimes and river flows (future research program)

Contracts for certain fish studies have been renewed to preserve a long term data base, avoiding gaps in the data. A large amount of research was conducted during the experimental flow as well. Future research and long term monitoring will be conducted through the Center.

2 - Protect humpback chub population and habitat in LCR by being instrumental in developing of a management plan.

Reclamation contracted with the Navajo Nation to prepare the plan. The Navajo Nation contracted with SWCA consulting firm to produce the document. A preliminary draft was prepared, and Reclamation and the Navajo Nation met to discuss modifications. Reclamation will provide final comments to SWCA by the end of November, 1996. It is anticipated the draft will be completed shortly thereafter. The draft will be circulated to FWS and any other interested party for comment and finalized upon incorporation of the comments. The final LCR Management Plan will then be transmitted to FWS and other parties with the jurisdiction and authority to implement it. Reclamation is willing to participate in the process in accordance with responsibilities under Section 7(a)(1) of the Endangered Species Act.

3 - Sponsor razorback sucker workshop

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. Representatives of State and Federal agencies from the seven Basin states, the environmental community, and water and power interests attended. Recognized native fish experts outlined the ecology, genetics, and threats to the razorback in the Colorado River system. The status of the razorback sucker population and a photographic tour of habitat in Glen and Grand Canyons was then presented. The workshop participants engaged in an active discussion, attempting to answer the questions: Should we manage for razorback suckers in this reach of the Colorado River; Can we manage them here; and, What specific actions should be taken in the next three to five years? Although many differing opinions were expressed, overall the group believed razorback suckers could, and should, be managed in Glen and Grand Canyons. Improved communication/dissemination of data, continued research, and investigating the control of non-native fish were the three major actions identified as being needed. The results of the workshop were sent to participants, including the FWS, on February 12, 1996.

The FWS will now recommend a course of action and develop a Memorandum of Understanding.

4 - Establish a second spawning population of humpback chub

Limited activities have taken place on this element. Some evaluation of the tributaries to determine suitability have been undertaken by the FWS through Reclamation funding. Additional work will be conducted through the Center.

Other work related to endangered species

A biological assessment is being prepared to evaluate the effects of the preferred alternative on the southwestern willow flycatcher. The draft is scheduled for completion by the end of November, 1996, and the final by the end of January, 1997. The expected outcome is a request for formal consultation.

Habitat and life history data have been collected on Kanab ambersnails (KAS), and populations were monitored during the experimental flow. Reclamation staff are participating regularly on a KAS working group. One of the activities recently initiated is the evaluation of the potential use of the grassy roof area of Glen Canyon Dam and power plant as a location to establish plant communities needed by KAS. It is thought that if a plant community could be established that possibly an experimental population or 'seed source' population could be used in the establishment of other populations.

Fish Data Integration Work

There are three individual efforts underway regarding native fishes, all of which contribute to the requirements of the Biological Opinion.

A. Arizona State University Summary - This is a summary of all information from GCES Phase II. It includes information on all resources and is similar to the 1988 report put out by Reclamation. It will also include information on what studies were conducted during the Beach/Habitat Building flow. The work is being done by a post doctoral student under W.L. Minkley.

B. Data Integration - During GCES Phase II, the fishery research was divided into four contracts, one each to BioWest; Arizona State University; Arizona Game and Fish; and the FWS. These 4 data sets will be linked and integrated by FWS (Owen Gorman).

C. Synthesis and Risk Analysis - Reclamation awarded a contract for this work through a competitive bid process. Steven W. Carothers and Associates were the successful bidders. SWCA will synthesize existing peer reviewed data and published data on flows and temperature, etc., related to native and non-native fishes to test the hypothesis that the benefits of steady flows to native fish outweigh the benefits to non-natives.

A final step in this process will be synthesis of other data, such as sediment resource data, with fish data.

The final analysis of whether an action is likely to jeopardize a species is to consider the aggregate effects of everything that has led to the species' current status, all future non-Federal activities, and the proposed action. Determination if an action is likely to destroy or adversely modify critical habitat is an assessment of whether all the aggregate effects on the critical habitat and its constituent elements will appreciably diminish the value of critical habitat in sustaining its role in the survival and recovery of the species. Thus, while other actions may be responsible for the humpback chub and razorback sucker being in decline before Glen Canyon Dam, or that cold water releases and reduction in sediment further impacted the native fishery, the Department of the Interior, with the Bureau of Reclamation as lead, is still responsible for the impacts of the proposed action of operation of Glen Canyon Dam as MLFF.

REASONABLE AND PRUDENT ALTERNATIVE

Regulations implementing section 7 define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that (1) can be implemented in a manner consistent with the intended purpose of the action, (2) can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction, (3) are economically and technologically feasible, and (4) would, the Service believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

The Service believes that elements of the reasonable and prudent alternative developed for this consultation meet the above four tests due to the following:

(1) There is an unique opportunity to conserve and protect endangered and other native fish fauna in an ecosystem designated as National Park Service lands for the preservation of these and other natural resource protection values from Glen Canyon Dam to Lake Mead. The Grand Canyon Protection Act of 1992 requires the Secretary of the Interior to "... protect, mitigate adverse impacts to, and improve values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established ..."

(2) Providing water storage and annual water releases of at least 8.23 maf to the lower basin States is a primary function of Glen Canyon Dam. The reasonable and prudent alternative will not conflict with this annual delivery of water. All flows requested in the reasonable and prudent alternative that are not part of the proposed action are within powerplant capacity. Lower basin deliveries of water are met from releases from Hoover Dam and, to a lesser extent, from Lake Mead and do not depend on daily or monthly releases from Glen Canyon Dam. Elements previously defined as conservation measures by Reclamation and the Service are presently being conducted within Reclamation's authority. A structure similar to the selective withdrawal structure identified here has been built and is being operated by Reclamation on Flaming Gorge Dam on the Green River.

(3) Elements of the reasonable and prudent alternative that address operations have been reviewed and included in the draft EIS as viable alternatives. Additional NEPA compliance would be necessary for a selective withdrawal structural element.

(4) The Service believes, that to prevent jeopardy to the endangered fish of Grand Canyon, restoration of the aquatic ecosystem by reducing, to the extent possible, known limiting factors and conducting appropriate research to identify and reduce suspected limiting factors will be necessary and can be accomplished with cooperation, innovative approaches, and elements of the following reasonable and prudent alternative.

ELEMENTS OF THE REASONABLE AND PRUDENT ALTERNATIVE

The following reasonable and prudent alternative contains elements that will focus on the community of endangered and native fish present in the Grand Canyon. The Service believes that actions for one native species should be supportive of other native species in the ecosystem. As the trend of more species becoming endangered or threatened continues in the Colorado River, the difficulties of recovering an ecosystem that is losing functional parts may become insurmountable. Therefore, the health of the entire native fish community will be crucial to the removal of jeopardy for the humpback chub and razorback sucker. We realize that not all of the elements can be implemented at once, and an implementation schedule has been noted for some elements. Those elements that can be accomplished without further verification or NEPA compliance should be implemented without delay. For some elements, such as the selective withdrawal structure, a schedule will be determined. Reclamation and the Service will meet at least annually to coordinate reasonable and prudent alternative activities. Such meetings will provide the Service an opportunity to determine whether sufficient progress is being made in accomplishing those actions set forth to remove jeopardy to federally-listed species impacted by operation of Glen Canyon Dam.

Refinement of specific flows is dependent on continued studies, including a period of experimental flows, that identify mainstem habitats affected by flows and responses by endangered fishes to those habitats. Successful completion of the reasonable and prudent alternative is necessary to remove jeopardy to the humpback chub and razorback sucker from the proposed action. The reasonable and prudent alternative will be accomplished when all elements of the selected alternative have been effected and studies confirm compatibility between these species requirements and the operation of Glen Canyon Dam.

The draft EIS has seven elements common to all but the unrestricted fluctuating flow alternatives. Six of those EIS common elements that would influence native and endangered fish are adaptive management, flood frequency reduction measures, habitat and beach building flows, establishing a new population of humpback chub, further study of selective withdrawal, and emergency operations exception criteria. Three of the EIS common elements that were identified by Reclamation and the Service as conservation measures (see BACKGROUND) are research or long-term monitoring (adaptive management), flood frequency reduction, and the second spawning population of humpback chub. Development of a management plan for the LCR was another conservation measure being conducted by Reclamation through GCES.

Because of the importance of the EIS common elements and conservation measures to the continued existence of the humpback chub, razorback sucker, and other Colorado River native fish, many of the elements and measures are included below as elements of the reasonable and

prudent alternative to assist in identification of actions necessary to be included in any future modification of the preferred alternative.

1. Attainment of riverine conditions that support all life stages of endangered and native fish species is essential to the Colorado River ecosystem. Therefore, Reclamation shall develop an adaptive management program that will include implementation of studies required to determine impact of flows on listed and native fish fauna, recommend actions to further their conservation, and implement those recommendations as necessary to increase the likelihood of both survival and recovery of the listed species.

The Adaptive Management Program, an EIS common element, was still being formulated as we prepared this biological opinion. The Service supports adaptive management as an iterative approach to resource management. We recognize that the aquatic and terrestrial ecosystems below Glen Canyon Dam are still adjusting to impacts from dam operations that will continue into the future. Thus, the need for adaptive management. Actions taken through this approach must be based on an integrated resource approach, and, as discussed by Hilborn (1992), an active rather than a passive learning system that includes deliberate experimental design.

A. A program of experimental flows will be carried out to include high steady flows in the spring and low steady flows in summer and fall during low water years (releases of approximately 8.23 maf) to verify an effective flow regime and to quantify, to the extent possible, effects on endangered and native fish. Studies of high steady flows in the spring may include studies of habitat building and habitat maintenance flows. Research design and hypotheses to be tested will be based on a flow pattern that resembles the natural hydrograph, as described for those seasons in the SASF.

Information from final GCES endangered fish reports, researchers who conducted those studies, and other knowledgeable individuals will be used to assist in determining an experimental flow regime of high spring flow and low summer and fall flow for endangered fishes and to develop hypotheses and studies to accompany those flows with final review and approval by the Service. Reclamation will provide technical assistance and funding.

Design of the experimental flows and associated studies will begin as soon as possible and be targeted for completion by October 1996. Unless the Service determines information provided seriously questions the validity of experimental designs developed or contribution of the resulting data to remove jeopardy to the federally-listed aquatic fauna of the Grand Canyon, experimental flows will be initiated in April 1997. If sufficient progress and good faith effort is occurring towards initiating experimental flows, implementation of experimental flows may occur later in 1997. If the Service believes there is not sufficient progress, Glen Canyon Dam would be operated as SASF flows during spring through fall (April to October) beginning in 1998. If the Service determines a study design can not be developed that is expected to provided information to support removal of jeopardy to the razorback sucker and humpback chub populations in the Grand Canyon and associated tributaries, such will be considered new information and may be grounds for reinitating formal consultation.

This element is based on low release years (8.23 maf) occurring approximately 50% of the time. Further improvement of the means for determining a low water year that would initiate the implementation of research flows in a given year will be developed by Reclamation with concurrence by the Service. This may include, for example, methods based on content of water in Lake Powell at a given date. When implemented, experimental flows will be conducted for a sufficient period of time to allow for experimental design, biological processes to function, and for variability inherent in riverine ecosystems to be expressed. The number of years to conduct the experimental flows is, therefore, indeterminate.

During moderate and high release years, Reclamation shall operate Glen Canyon Dam according to requirements of the MLFF. Operations during moderate and high water years would assist in achieving some of the variability that was always present in the historic Colorado River and under which the endangered and other native fish evolved.

Following analysis of the data, appropriate operational flows will be determined by the Service and implemented by Reclamation in compliance with section 7(a)(2), Endangered Species Act.

B. Reclamation shall implement a selective withdrawal program for Lake Powell waters and determine feasibility using the following guidelines.

- i. Review historic information and employ existing modeling with possible updates using alternative reservoir and operating conditions to prepare a set of possible scenarios of temperature changes in the mainstem.
- ii. Determine from the literature, experimentation, and consultation with the AGFD, Native American Tribes, National Park Service, Service, and other native fish species experts the anticipated effects on native fish populations which may result from implementation of temperature changes from a selective withdrawal structure. Determine the range of temperatures for successful larval fish development and recruitment and the relationship between larval/juvenile growth and temperature.
- iii. Assess the temperature induced interactions between native and non-native fish competitors and predators.
- iv. Assess the effects of temperature, including seasonality and degree, on *Cladophora* and associated diatoms, *Gammarus*, aquatic insects, and fish parasites and disease.
- v. Evaluate effects of withdrawing water on the heat budget of Lake Powell, effects of potentially warmer inflow into Lake Mead, and the concomitant effects on the biota within both reservoirs. Evaluate the temperature profiles along with heat budget for both reservoirs.
- vi. Evaluate effects of reservoir withdrawal level on fine particulate organic matter and important plant nutrients to understand the relationship between withdrawal level and reservoir and downstream resources.



United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

UC-320
ENV-7.00

MAR 13 1997

MEMORANDUM

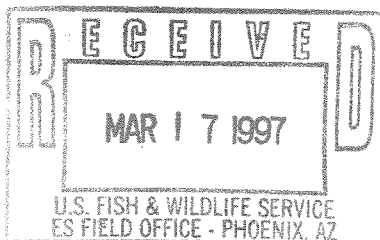
To: Field Supervisor, U.S. Fish and Wildlife Service, Ecological Services,
2321 W. Royal Palm Road, Suite 103, Phoenix, AZ 85021

From: Bruce C. Moore
Associate Manager, Resources Management Division

Subject: Review of Sufficient Progress in Implementing the Elements of the
Reasonable and Prudent Alternative for the Operations of Glen Canyon Dam

On November 27, 1996, we transmitted to you an account of the progress that has been made to date in implementing the recommendations in the Reasonable and Prudent Alternative contained in the Biological Opinion on the Operation of Glen Canyon Dam issued by your office on December 21, 1994 (2-21-93-F-167). Our memorandum also contained an evaluation of the degree of progress, concluded that it has been sufficient and a requested a response. Discussions with your staff confirm the letter is on file in your office. We request that you respond to this memorandum at your earliest convenience. If we do not hear from you within 30 days, we will assume you concur with our finding of sufficient progress.

Bruce C. Moore





United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, Utah 84138-1102

IN REPLY REFER TO:

UC-320
ENV-1.10

DEC 12 1997

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service, 2321 W. Royal Palm Road,
Suite 103, Phoenix AZ 85021-4951 (Attn: Debra Bills)

From: *CA* Charles A. Calhoun
Regional Director

Subject: Review of Sufficient Progress in Implementation of the Elements of the Reasonable and Prudent Alternative from the December 21, 1994, Biological Opinion on the Operations of Glen Canyon Dam.

The Bureau of Reclamation has reviewed the elements of the Reasonable and Prudent Alternative contained in the Glen Canyon Dam Operations Biological Opinion and our progress to date in implementing them. A detailed description of the status of each element is attached for your review. Based on this review, we have concluded that progress to date is sufficient.

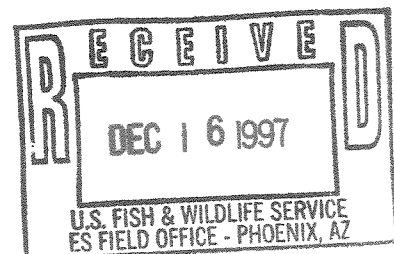
We intend to continue working diligently to complete the remaining work and will keep you apprised of our progress. A meeting has been scheduled between members of our staff to review the progress on implementation of the Biological Opinion in your office on December 16, 1997. We would appreciate your written view on this conclusion shortly after the meeting.

Should you need further information or clarification on any of this information, contact Christine Karas, Environmental Resources Group, Salt Lake City, at (801) 524-3829.

Bruce C. Moore

Attachment

cc: Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement,
P.O. Box 1306, 500 Gold Avenue, Albuquerque NM 87103
Dave Garrett, Grand Canyon Research and Monitoring Center, 2255 N. Gemini
Drive, Room 341, Flagstaff AZ 86001
Members of the AMWG and TWG (attached mailing list)
UC-105, -205, 333, -346
(ea w/atch)



PROGRESS REVIEW - IMPLEMENTATION OF THE GLEN CANYON DAM OPERATIONS BIOLOGICAL OPINION

December 5, 1997

The following summary of progress made in implementation of the Glen Canyon Dam Biological Opinion was originally prepared on November 27, 1996, concluding progress to that date had been sufficient. You responded on April 3, 1997 in disagreement with that conclusion. The summary has been updated to reflect the current status of elements of the biological opinion. Of the 7 elements of the biological opinion, 3 have been completed, 3 are currently on going, 1 has had a preliminary work initiated.

1 - Adaptive Management Program (AMP)

The Record of Decision on the Environmental Impact Statement on the Operations of Glen Canyon Dam was signed on October 9, 1996, formally sanctioning the preferred alternative, including the AMP and the Grand Canyon Research and Monitoring Center. Through the efforts of the Transition Work Group, which was organized in the interim to continue work on the AMP, a charter was developed and put into place establishing the AMWG as a Federal Advisory Committee. Steve Magnussen has been appointed as the Secretary's designee, Committee members have been designated for the 25 participants, and the first Adaptive Management Work Group meeting was held on September 10 and 11, 1997. The AMWG establish a Technical Work Group, which has been meeting regularly.

This element of the biological opinion has been completed.

1.A - A Program of Experimental Flows

The RPA recommends that a program of experimental flows be carried out, including: high steady flows in the spring, and low steady flows in summer.

A beach/habitat building flow of 45,000 cfs, including appropriate up and down ramps, was conducted in March, 1996. Prior to conducting this flow, National Environmental Policy Act (NEPA) compliance, in the form of an environmental assessment (Reclamation, February, 1996); and, Endangered Species Act consultation through preparation of a biological assessment (BOR, November 1995) and a biological opinion (FWS, November, 1995) were required because the ROD had not been signed. A full research program to evaluate this experimental flow accompanied the release. These compliance and research activities required substantial staff time and effort, as well as financial resources. The final reports analyzing the effects of the habitat/beach building flow, including peer review, were completed December 31, 1996. Final analysis and integration of the data will require approximately one additional year and should be available in late 1997. A symposium was held April 2-3, 1997 by the Grand Canyon Monitoring and Research Center to report preliminary results of the test flow.

In addition, a 48-hour short duration high release test flow was conducted November 3 through November 5, 1997, in response to unusually high inflow of sediment from the Paria River. This action was designed to conserve sediment resources as identified in the EIS and the BO. However, the test flow recommended by the AMWG was outside the parameters originally consulted on under the Endangered Species Act, and to which the National Environmental Policy Act had been applied. Due to the take of endangered humpback chub and Kanab ambersnail, biological assessment (BOR, November 1997) and a Biological Opinion (FWS, November 1997), as well as the required NEPA evaluation in the form of a categorical exclusion checklist was completed.

High spring flows - completed

The BO also recommended: "... testing of low steady flows in summer and fall during low water years. Information from final GCES endangered fish reports, researchers who conducted those studies and other knowledgeable individuals are to be used to develop hypotheses and studies to accompany those flows. Design of the experimental flows and associated studies will begin as soon as possible and be targeted for completion by October 1996". The BO also recommended the experimental flows begin in April, 1997, or alternatively, if sufficient progress was not being made in implementation of the RPA, they would begin April of 1998. The BO goes on to say that implementation of low steady flows would occur in 8.23 maf water years.

Reclamation accepted the Service's recommended RPA in an April 6, 1995 response to the BO. This letter of response indicated how Reclamation would implement the RPA. In this response, Reclamation articulated that: 1) implementation of experimental flows are to be coordinated through the AMP; 2) the flow experiments will include scientifically based peer reviewed criteria to measure and evaluate their impacts on downstream resources; the research would be managed and administered through the GCMRC; and that appropriate staff and funding levels needed to be identified. This memorandum was distributed to all cooperating agencies and interested parties.

To progress toward completion of this portion of this element of the RPA, the Grand Canyon Monitoring and Research Center (GCMRC) has been established. Dr. David Garrett, as director of the research center, and the program managers on his staff, have conducted multiple meetings and formulated both a Long Term Research and Monitoring Plan (GCMRC, 1996) and an Annual Plan (GCMRC, 1996) in cooperation with the transition work group members. These plans are designed to evaluate the effects of the various flows regimes as called for in the biological opinion (BO).

The description of the low steady flow in the BO was conceptual, based in part on the goal of restoring a natural hydrograph to the extent possible under current conditions. Prior to completing a plan for the research and monitoring of these flows, specific parameters must be developed and submitted to the TWG and AMWG. The final description of these flows will be subject to approval by the Service.

It has been Reclamation's intent to have in hand a report which integrates the research to date on the fish in Grand and Glen Canyons. This work is underway through a competitive bid contract let by Reclamation. Administration of this contract was transferred to the GCMRC in keeping with Reclamation's plan to implement the RPA, as described above. However, the Service recommended work on defining the specific flows occur simultaneously. A meeting was held on October 29, 1997 to begin an informal discussion of the goals and conditions under which this flow would be beneficial to the endangered fish. During this meeting it was reported by a Reclamation hydrologist that 8.23 million acre foot years, which is one of the criteria for conducting the low steady flow experiment, would not occur approximately one half the time as reported in the EIS, but would actually occur much less frequently. Review of portions of the BO and discussion with the Service led the group to conclude that if water releases were going to be approximately 10,000 maf or less in any given water year, the goals of the low flow concept could still be tested. Rather than basing criteria on a specific flow, the group agreed to pursue the development of a general release pattern water years of 10,000 maf or less. The actual releases would then be determined by the hydrology. A summary of the main points of discussion from this meeting will be sent to the AMWG and TWG.

During the week of December 8, 1997. Low steady flows will not be implemented in 1998 as called for in the opinion, because the forecast does not predict an 8.23 maf water year. The opinion allows for implementation of the preferred alternative (ROD) in high and medium water years.

This element of the RPA cannot be considered delinquent considering that the time of implementation is April, 1998, it is not an 8.23 maf year, the high flow portion of this element has been completed, and considerable progress toward achieving low flows has occurred. This element of the biological opinion is ongoing.

1.B - Selective Withdrawal Program for Lake Powell

Reclamation selected Mr. Dave Truman to manage the effort of investigating the feasibility of a selective withdrawal program. Funding has been programmed to continue working toward a decision regarding selective withdrawal.

Initial scoping identified the need for certain studies. These studies have been completed and the reports are being distributed. They are: (1) a Value Planning Study which screened alternatives available to control temperatures; (2) a Feasibility Study which evaluated the cost of three alternatives for temperature control, and (3) a study of benthic ecology, which includes an evaluation of warmer water on Gammarus.

The cost to construct a traditional selective withdrawal device was estimated to be between \$40 million & \$150 million. Give the uncertainties of the effects of such a device on native-nonnative interactions, parasite populations, and other potential effects on native fish, and the need to justify this large expense to congress when seeking appropriations, the Value Planning Study was conducted. An experimental design for modifying the penstock intakes has been developed with an estimated cost of \$15 million. Preparation of an environmental assessment is scheduled to begin in fiscal year 1998.

Reclamation is continuing to develop a computer model of the reservoir and model for the river. To expedite the process, Reclamation's Technical Service Center is beginning the 2-year process to prepare designs and a bid package in the event this alternative is selected. Reclamation is working to secure funding through direct appropriations from Congress beginning with the Fiscal Year 2000 budget.

This element is Ongoing. Actions to complete this item have been accelerated, and it is several years ahead of the schedule originally presented to the Transition Work Group.

1.C - Determine responses of native fish to various temperature regimes and river flows (future research program)

The contracts for certain fish studies which were on-going upon completion of the EIS were renewed to preserve a long term data base, avoiding gaps in the data. A large amount of research was conducted during the experimental flow as well. Future research and long term monitoring will be conducted through the GCMRC which has begun funding research for fiscal year 1998. As mentioned earlier, the GCMRC staff has developed long term and annual research and monitoring plans. Funds have been budgeted to complete the work.

This element is ongoing

2 - Protect humpback chub population and habitat in LCR by being instrumental in developing of a management plan.

Reclamation contracted with the Navajo Nation to prepare the plan. The Navajo Nation contracted with SWCA consulting firm to produce the document. A preliminary draft was prepared and Reclamation and the Navajo Nation met to discuss modifications. In the process of transition between Glen Canyon Environmental Studies and the GCMRC this contract expired. The final product did not address certain issues which Reclamation believes are important to accomplishing the protection of the fish. A new cooperative agreement between Reclamation and SWCA is currently being finalized. The final LCR Management Plan will then be transmitted to the Service and other parties with the jurisdiction and authority to implement it. Reclamation is willing to participate in the implementation process in accordance with responsibilities under Section 7(a)(1) of the Endangered Species Act.

This element is ongoing

3 - Sponsor razorback sucker workshop

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. Representatives of State and Federal agencies from the seven Basin states, the environmental community, and water and power interests attended. Recognized native fish experts outlined the ecology, genetics, and threats to the razorback in the Colorado River system. The status of the razorback sucker population and a photographic tour of habitat in Glen and Grand Canyons was then presented. With this background, the workshop participants then engaged in an active discussion, attempting to answer the questions 'Should we manage for razorback sucker in this reach of the Colorado River; Can we manage them here; and, What specific actions should be taken in the next three to five years?' Although many differing opinions were expressed, overall the group believed razorback sucker could, and should be managed in Glen and Grand Canyons, and improved communication/dissemination of data, continued research, and investigating the control of non-native fish were the three major actions identified as needed. The results of the workshop were sent participants, including the Service, on February 12, 1996.

The Service will now recommend a course of action and develop a Memorandum of Understanding to further the process.

Completed

4. Establish a second spawning population of humpback chub

Limited activities have taken place on this element. Some evaluation of the tributaries to determine suitability have been undertaken by the Service through Reclamation funding. Havasu Creek was identified as the location with the greatest likelihood of success. The Supai tribe has indicated they are not amenable to having endangered fish in this area. Further discussion will take place in the future. Considering the preferred location of a second spawning population of humpback chub is in the mainstem Colorado River, and that establishment is largely dependent upon warmer water temperatures, success is dependant on the selective withdrawal structure. Therefore, the available staff and funding resources have been applied to the other items, which are expected to produce tangible benefits for endangered species much more quickly. Reclamation has requested that the service provide a clear definition of what constitutes a secondary population, or, that they define a process by which a site specific definition can be developed.

Preliminary work has been initiated

Other work related to endangered species

The Service rendered an additional biological opinion to address the one-time test of a beach/habitat building flow in 1996. In the resulting opinion, the Service concluded that incidental take limits could be exceeded, and developed reasonable and prudent measures (RPM) to reduce the level of incidental take. In RPM number 2 the Service stated that "Before another habitat-building flow, Reclamation will enter into informal consultation with the Service to evaluate test flow studies, the establishment or discovery of a second population of Kanab ambersnail in Arizona, and .."

This second population has not been established or discovered, however several efforts have advanced the goal of establishing such a population a great deal.

Efforts Toward Recovery

1. A Kanab ambersnail working group has been formed, and meets regularly to discuss and recommend actions which will lead to the recovery of the species. Members of the group are the National Park Service, Arizona Game and Fish Department (AGF), Fish and Wildlife Service (Service), Grand Canyon Monitoring and Research Center, CUP Completion Act office (CUPCA), the Phoenix Zoo, Reclamation, and at times the Bureau of Land Management.
2. The habitat at Vaseys Paradise has been evaluated and monitored. Habitat at minus ninemile and Indian Gardens in Grand Canyon, and at Three Lakes near Kanab Utah has also been evaluated. This work, together with information from Spammer allowed for a better understanding of the KAS habitat requirements. The AGF developed habitat criteria, which was then evaluated by the KAS working group. This criteria was used to evaluate over 135 sites, in Grand Canyon, Upper Kanab Canyon, the Hualapai Reservation, and off Mogollon Rim, AZ, to determine if additional populations were present AGF's 12-step proceed if suitable habitat for reintroduction could be identified. Procedures which comply with AGF's 12-step process and permits to be issued by the FWS are being pursued toward the goal of establishing the second population.
3. A separate study is ongoing at Northern Arizona University which is propagating the host plant species and culturing KAS for Research proposals. Ability to propagate the host plant may be useful in enhancing potential introduction sites.
4. Based upon a recognition that a secure area, with a reliable water source, the proper micro climate, and easy access was needed to test information previously collected from a NAU study in an indoor setting prior to reintroducing or introducing a second population, the roof of Glen Canyon Dam was selected as a sight for this work. Reclamation has received a request from the GCMRC/NAU for use of the area, and the project is moving forward.
5. The Phoenix Zoo has agreed to house a population of KAS and a suitable location has been selected. The habitat for this population is being prepared and should be ready for occupancy in November, 1997.
6. A contingency protocol has been developed through the KAS working group outlining procedures and chain of communication for salvaging snails from Vaseys Paradise should hydrologic conditions or management actions threaten to take snails.

Note: Funding for these efforts has been provided through FWS Section 6 funds, AGF provided funds to match the Section 6 funds, appropriated Reclamation funds programmed for recovery activities, and the Central Utah Project Completion Act. No GCES funds, and no power revenues were expended on any of these efforts.

In November of 1997, in response to a request from the AMWG for another high flow designed to conserve sediment, another biological opinion to address that action was issued by the Service. Reclamation accepted the reasonable and prudent measures and terms and conditions. This required logistical support to Arizona Game and Fish for completing work on salvage and refugia populations of KAS, and development of a survey plan to evaluate displacement of young-of-the-year humpback chubs. A cooperative agreement with AGF will be modified to include logistical support, and work on the plan has begun.

Southwestern Willow Flycatcher

The SWWF was not listed when consultation on the preferred alternative took place, and was therefore not consulted on. As a result of the 1996 BO, Reclamation agreed to initiate consultation in early 1997. A draft BA has been prepared for this consultation. Reclamation is has not initiated this consultation for several reasons: these include staff priorities being shifted to other Glen Canyon items in light of the results of the data from the 1996 test flow which showed no effect to SWWF or their critical habitat from the 45,000 release; waiting for the results of other studies funded by Reclamation on the SWWF, and a consultation and law suit involving the SWWF and the Lake Mead Delta. The BA on the SWWF is currently scheduled to be completed in December, 1997.

Fish Data Integration Work

There are three individual efforts underway regarding native fishes, all of which contribute to the requirements of the Biological Opinion.

A. A summary of biological information from GCES Phase II. It includes information on all resources and is similar to the 1998 report put out by Reclamation. It will also includes information on what studies were conducted during the Beach/Habitat Building flow. The work is being done by a post doctoral student under W.L. Minkley.

B. Dr. Schmidt is preparing a similar report on the physical data.

C. Data Integration - SWCA is preparing an integration report which also examines the data available on what effects can be anticipated from low steady summer flows.

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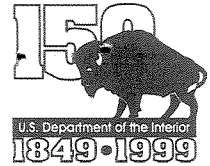
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IN REPLY REFER TO:

UC-333
ENV-1.10

FEB 25 1999

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service, Attention: Debra Bills
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From: Charles A. Calhoun
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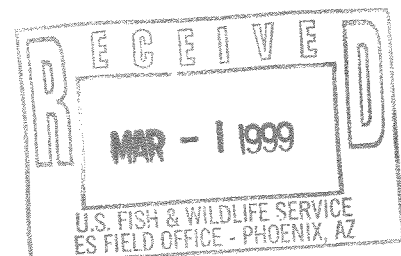
Subject: Implementation Status of the elements of the Reasonable and Prudent
Alternative from the December 21, 1994, Biological Opinion on the Operations
of Glen Canyon Dam.

A detailed description of the status of each element of the Reasonable and Prudent Alternative (RPA) contained in the 1994 Glen Canyon Dam Operations Biological Opinion is attached for your review and comment.

Tony Morton of our Environmental Resources Group in Salt Lake City, will be contacting you to arrange a time and place for the annual meeting to further coordinate reasonable and prudent alternative activities. Meanwhile, please contact Tony at (801) 524-3829 if you have any questions.

Attachment

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1998 PROGRESS REVIEW
IMPLEMENTATION OF THE GLEN CANYON DAM OPERATIONS BIOLOGICAL OPINION

This is Reclamation's third progress report for implementation of the RPA for the 1994 Glen Canyon Dam Operations Biological Opinion. Each review included at least one meeting between the staffs of Reclamation and the Service. The first progress report was prepared on November 27, 1996, and the Service formally responded in April 1997. The second report was completed on December 5, 1997, with no formal response received from the Service.

As of the end of 1998, five of the seven elements of the biological opinion are ongoing, with one item completed and another awaiting followup action by the Service.

Following is a discussion of each element.

ELEMENT 1

Reclamation shall develop an adaptive management program (AMP.)

PROGRESS ELEMENT 1

The Record of Decision for the Operations of Glen Canyon Dam was signed on October 9, 1996, formally sanctioning the preferred alternative as described in the EIS, including the AMP and establishment of the Grand Canyon Monitoring and Research Center (GCMRC.) Through the efforts of the interim Transition Work Group, work on the AMP continued until a charter was developed and put into place establishing the Adaptive Management Work Group (AMWG.) The AMWG now operates as a Federal Advisory Committee (FAC,) with Mr. Steve Magnussen appointed as the Secretary of the Interior's designee. FAC members have been designated for the 25 participants, and the first AMWG meeting was held during September 1997. The AMWG established a Technical Work Group, which has been meeting regularly since September 1997. A Science Advisory Board, providing independent scientific review of the AMP, will begin work in 1999.

Specific management objectives and prioritized information needs for endangered species affected by operations of Glen Canyon Dam have been developed by the Technical Work Group and adopted by the Adaptive Management Work Group. The objectives and information needs are intended to help define measurable standards of desired conditions for each endangered species and come directly from the RPA, reasonable and prudent measures (RPM,) conservation measures, and incidental take statements in the 1994 opinion, and from measures and take statements in the 1996 and 1997 opinions. The objectives and information needs also provide the basis for the long-term monitoring and research program for endangered species.

On April 23, 1998, fourteen stakeholders from the Adaptive Management Program met and developed scheduling priorities for information needs. The results indicate a concern to focus in areas of biology, especially endangered species. The prioritization was approved by the AMWG in July 1998. The GCMRC will use that information in programming monitoring and research from FY2000-2004.

STATUS OF ELEMENT 1

COMPLETED. The AMP has been developed and implemented.

ELEMENT 1.A

Carry out a program of experimental flows, including high steady flows in the spring and low steady flows in summer and fall during low water years. The RPA set forth a schedule for development and implementation of low flows. Design of experimental flows and associated studies were to be completed by October 1996. Unless the Service doubted the validity of the study design or the ability of the flow to contribute to removal of jeopardy, the flows were to be implemented in April 1997. The flows could begin even later in 1997, if good faith effort to make sufficient progress were demonstrated. Absent sufficient progress, flows were to be implemented in the spring of 1998.

PROGRESS ELEMENT 1.A.

Although a release combining both high steady spring flows and low steady summer and fall flows has not been realized, test of a high spring flow was completed in March, 1996. Research during the 1996 experimental beach/habitat-building flow (BHBF) concluded that the 45,000 cfs stage had the effect of filling in some return channels, thus reducing backwater numbers. Backwater numbers have also decreased since April 1996 due to deposition of sediment into the return channel and erosion of higher elevation reattachment bars.

Timing, duration and magnitude of BHBFs, and effects on endangered species, are still subject to speculation and require further testing and validation. In addition to achieving anticipated benefits to humpback chub habitat, higher stage experimental BHBFs have been recommended to test the precision of estimated stage-to-discharge relationships at terrestrial endangered species sites, including Kanab ambersnail habitat at Vaseys Paradise, and the four historic southwestern willow flycatcher nesting sites.

A low flow study design has not been done, and the low flows have not been implemented. Low steady flows were not implemented in 1998, as called for in the opinion, because the forecast did not predict an 8.23 maf water year. The opinion recognizes that during moderate and high release years, Reclamation shall operate Glen Canyon Dam according to requirements of the Modified Low Fluctuating Flow (preferred) alternative. Progress is being made for planning for a low flow, so that when an 8.23 maf release is projected, Reclamation can be prepared to coordinate with the other participants in the AMP and implement the test flow.

Reclamation accepted the Service's recommended RPA in an April 6, 1995 response to the BO. This letter of response indicated how Reclamation would implement the RPA. In this response, Reclamation articulated that:

- 1) implementation of experimental flow are to be coordinated through the AMP;
- 2) the flow experiments will include scientifically based peer reviewed criteria to measure and evaluate their impacts on downstream resources; the research would be managed and administered through the GCMRC; and that appropriate staff and funding levels needed to be identified. This memorandum was distributed to all cooperating agencies and interested parties.

In 1997, Reclamation contracted with SWCA, Inc. Environmental Consultants, to summarize and evaluate known information about native and non-native fishes in Glen and Grand Canyons. The

final SWCA "Grand Canyon Data Integration Project Synthesis Report" (synthesis report) was submitted to Reclamation on July 1, 1998, and a copy was provided to the Service. The report confirmed the value of testing response hypotheses for steady flows, but concluded that sufficient baseline data to fully evaluate the steady flow experiment do not currently exist. It is expected that steady flows would simultaneously benefit both native and non-native fishes (perhaps to the detriment of native fishes), would reduce food drift, and would likely increase the incidence of fish parasites.

Review of the final synthesis report indicates that researchers identified 11 significant data gaps and recommended initiating studies at least 2 years in advance of any experimental low steady flow to fill in the identified data gaps and establish a baseline for comparison. The synthesis report also recommended developing non-native fish control strategies before performing any experimental steady flows. Twenty-four testable hypotheses were developed.

The 1999 Research and Monitoring Plan for GCMRC, as approved by the AMWG, includes provisions for development of a low steady flow research plan. The GCMRC has requested proposals from interested parties to develop a research and implementation plan for one or more experimental flows, consistent with the 1995 biological opinion. Resources available to assist in the development of the plan include the 1998 SWCA Data Integration Report, Synthesis of Glen Canyon Environmental Studies Phase II biological and physical science activities (D. Patten, 1998,) and a conceptual model of the aquatic ecosystem linked to dam operations (Walters, et. al., 1998.) These sources will also be used as guidelines determine the validity of proposed experimental designs and to call attention to issues of concern that are related to experimental flows.

STATUS OF ELEMENT 1.A.

ONGOING. Additional testing and confirmation of benefits of the high spring release is needed, and a test combining high steady spring flows and low steady summer flows needs to be developed and implemented. As mentioned in the Service's April 1997 response to the progress review, consideration should be given to at least conducting habitat maintenance flows (33,200 cfs) during low water release years.

Reclamation will address combined high steady spring and low steady summer/fall flows and habitat maintenance flows in low water years in the planned NEPA/ESA programmatic compliance effort for beach/habitat building flows, and other special flows, scheduled to begin in 1999. GCMRC is in the final stages of review of Requests for Proposal for the design of a low flow study. The contractor selected will then complete the design during FY 99. Included will be consideration of the recommendations in the synthesis report.

ELEMENT 1.B

Reclamation shall implement a selective withdrawal program for Lake Powell waters and determine feasibility.

PROGRESS ELEMENT 1.B.

Initial scoping identified the studies needed to more completely evaluate the selective withdrawal program (temperature control device). Those studies have been completed and the reports were

distributed during 1997-1998. They include: (1) a Value Planning Study which screened alternatives available to control temperatures; (2) a Feasibility Study which evaluated the cost of five alternatives for temperature controls, and (3) an evaluation of aquatic food resources completed in October 1997, "Benthic Ecology of the Colorado River System Through the Colorado Plateau Region of the Southwestern United States," which includes an evaluation of warmer water on Gammarus.

An experimental design for modifying the penstock intakes was developed, with an estimated cost of \$15 million. A draft environmental assessment (EA) was completed for TWG Review on June 22, 1998. The public draft EA was distributed in early January 1999 for a 60-day review period. Based on requests by members of the AMWG, a peer review panel will be assembled beginning in March 1999 to evaluate the information presented in the draft EA.

STATUS OF ELEMENT 1.B.

ONGOING. Funding has been programmed to continue working toward a decision regarding a temperature control device (selective withdrawal.) Actions to complete this item have been accelerated, and it is several years ahead of the schedule originally presented. Based on the EA, Reclamation, in consultation with the Service and other members of the AMWG, will decide to either pursue construction and testing of the structure (assuming there is a finding of no significant impact projected for construction and testing), initiate further investigations which could involve proceeding to an environmental impact statement (assuming there are potential significant impacts associated with construction and testing), or take no action (assuming there is a finding of significant impacts projected for construction and testing with no known acceptable avoidance or mitigation.)

ELEMENT 1.C.

Determine responses of native fishes in Grand Canyon to various temperature regimes and river flows of the experimental flows and other operations of Glen Canyon Dam.

PROGRESS ELEMENT 1.C.

The contracts for certain fish studies, which were on-going upon completion of the EIS, were renewed to preserve a long term data base, avoiding gaps in the data. Research was conducted during the 1996 experimental BHBF as well. Future research, and long term monitoring, will be conducted through the GCMRC, in coordination with the TWG. Both Reclamation and the Service are represented on the TWG.

STATUS OF ELEMENT 1.C.

ONGOING. The GCMRC staff has developed long term and annual research and monitoring plans, working closely with Reclamation and the Service through the TWG. It is during this process that specific research and monitoring needs identified by the Service in the biological opinion, or subsequently identified by the Service's TWG/AMWG members, are identified and incorporated for review and approval by the AMWG. Funds have been budgeted to complete the work.

ELEMENT 2

Protect humpback chub spawning population and habitat in the Little Colorado River by being instrumental in developing of a management plan for this river.

PROGRESS ELEMENT 2

Reclamation contracted with the Navajo Nation to prepare the plan. The Navajo Nation contracted with SWCA Inc. Environmental Consultants to produce the document. A preliminary draft was prepared and Reclamation and the Navajo Nation met to discuss modifications. In the process of transition between Glen Canyon Environmental Studies and the GCMRC this contract expired. The final product did not address certain issues which Reclamation believes are important to accomplishing the protection of the fish. A new cooperative agreement between Reclamation and SWCA was finalized and a new draft was issued in late November 1998.

STATUS OF ELEMENT 2

ONGOING. The LCR Management Plan is approaching final draft form and will be transmitted to the Service, Navajo Nation, Hopi Tribe, National Park Service, Bureau of Indian Affairs, and Arizona Game and Fish Department, for review and comment prior to finalizing. Those parties with the jurisdiction and authority would be expected to implement the appropriate elements and recommendations. Because a successful management program requires involvement of tribes, state and federal entities, a process is needed to facilitate bringing those groups together, including funding, to adopt and implement the LCR plan. Even though the LCR is mostly unaffected by dam operations (the area of confluence of the LCR and Colorado River is the exception,) and is not within the jurisdiction of Reclamation, Reclamation is willing to participate in the implementation process, in accordance with responsibilities under Section 7(a)(1) of the Endangered Species Act.

ELEMENT 3

Develop actions that will help ensure the continued existence of the razorback sucker by first sponsoring a workshop within 1 year following the biological opinion...following review of the workshop results, the Service will recommend a course of action and develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

PROGRESS ELEMENT 3

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. The results of the workshop were sent participants, including the Service, on February 12, 1996.

STATUS OF ELEMENT 3

ONGOING. Reclamation has completed the first step. The second step calls for the Service to recommend a course of action and develop a Memorandum of Understanding to further the process. We are unaware of any progress to date on development of an MOU.

ELEMENT 4

Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

PROGRESS ELEMENT 4

Some evaluation of the tributaries to determine suitability have been undertaken by the Service, funded by Reclamation. Havasu Creek was identified as the location with the greatest likelihood of success. The Supai tribe has indicated they are not amenable to having endangered fish in this area. Considering the preferred location of a second spawning population of humpback chub is in the mainstream Colorado River, and that establishment is largely dependent upon warmer water temperatures, success is likely dependant on the temperature control device currently under consideration, and/or implementation of low steady summer flows. Therefore, the available staff and funding resources have been applied to those other items, which are expected to produce tangible benefits for endangered species much more quickly.

STATUS OF ELEMENT 4

ONGOING. Efforts related to establishment of a second spawning aggregation of humpback chub are being focused primarily on the assessing the feasibility of a temperature control device and testing of low steady flows, however, funding has also been made available through the adaptive management program to develop a report and schedule describing the steps required to accomplish establishment of a second population of humpback chub in the Colorado River ecosystem. The GCMRC is expected to award the contract sometime in March 1999.



United States Department of the Interior

BUREAU OF RECLAMATION

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IN REPLY REFER TO:

UC-702
ENV-7.00

MAY 8 2002

MEMORANDUM

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From: ^{Acting} Rick L. Gold
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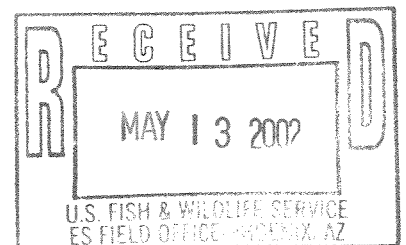
Subject: Implementation Status of the Elements of the Reasonable and Prudent
Alternative from the December 21, 1994, Biological Opinion on the Operations of
Glen Canyon Dam

A detailed description of the status of each element of the referenced Reasonable and Prudent Alternative (RPA) is attached. We appreciate the willingness of your staff to work with us in completing this assessment. Dennis Kubly of our Adaptive Management and Environmental Resources Division will serve as the point-of-contact for coordination of RPA activities. Please contact him at (801) 524-3715 if you have any questions.

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1999-2001 PROGRESS REVIEW
IMPLEMENTATION OF THE GLEN CANYON DAM OPERATIONS
BIOLOGICAL OPINION

This is Reclamation's fourth progress report for implementation of the Reasonable and Prudent Alternative (RPA) for the 1994 Glen Canyon Dam Operations Biological Opinion. It addresses activities completed during calendar years 1999-2001. Each previous review included at least one preliminary communication between the staffs of Reclamation and the Service. The first progress report was prepared on November 27, 1996, and the Service formally responded on April 3, 1997. The second report was issued on December 12, 1997. No formal response was received from the Service. The third report was sent on February 25, 1999, and the Service responded on May 27, 1999.

At the close of calendar year 2001, five of the seven elements of the biological opinion are in progress, with one item completed and another awaiting follow-up action by the Service.

Following is a discussion of each element.

ELEMENT 1

Reclamation shall develop an adaptive management program (AMP).

PROGRESS ON ELEMENT 1

The Glen Canyon Dam AMP retains the same organizational structure as presented in the last sufficient progress communication. A review of the 1997 GCMRC Strategic Plan, as amended, was conducted by a National Research Council committee and published in 1999 (National Research Council 1999). The AMP Charter was renewed in January 2001. New and continuing representatives to the Adaptive Management Work Group (AMWG) were confirmed by the Secretary of the Interior during 2001. Protocol Evaluation Panels have provided evaluations and recommendations for Grand Canyon Monitoring and Research Center's (GCMRC) programs in Physical Resources (Wohl and others 1999), Cultural (Doelle 2000), Terrestrial Biology (Urquhart and others 2000), Trout Fishery (Culver and others 2000), Integrated Water Quality (Jones and others 2001), and Aquatic Studies (Anders and others 2001) investigations. Each of these reviews has resulted in modifications to the GCMRC monitoring and research protocols. The Science Advisory Board, which provides advice and counsel to GCMRC and the AMP, was convened in 2001. Results of the first major experiment conducted under the auspices of the AMP, the controlled flood of March-April 1996, were published in two collected works (Webb and others 1999, Patten and Stevens 2001). A very important step in developing an ecosystem-based science program has been the development of a conceptual model of the Colorado River ecosystem in the Grand Canyon region (Walters and others 2000). A complementary exercise has been the development of the AMP strategic plan, which has been recommended for adoption to the Secretary of the Interior by the AMWG.

STATUS OF ELEMENT 1

Completed. The AMP has been developed and implemented.

ELEMENT 1.A

Carry out a program of experimental flows, including high steady flows in the spring and low steady flows in summer and fall during approximately 8.23 million acre foot (maf) water years. The RPA set forth a schedule for development and implementation of experimental flows. Design of experimental flows and associated studies were to have been completed by October 1996. Unless the Service doubted the validity of the study design or the ability of the flow to contribute to removal of jeopardy, the flows were to be implemented in April 1997. The flows could begin even later in 1997, if good faith effort to make sufficient progress was completed. Absent sufficient progress, flows were to be implemented in spring of 1998.

PROGRESS ON ELEMENT 1.A

Previous communications have identified the implementation of a beach habitat building flow in March-April of 1996 and a habitat maintenance flow in November 1997. During 1998 and early 1999 Reclamation and the Service exchanged several draft environmental compliance documents pursuant to planning for another beach habitat building flow anticipated sometime in the period May-July 1999, however triggering criteria for this controlled release did not materialize. In September 1999, a presentation was made to the TWG by Dr. Richard Valdez on a report (Valdez and others 2000a) to GCMRC providing recommended hydrology to assess this element of the RPA. The report contained a proposed 3-year program of experimental flows, consisting of one year of the EIS preferred alternative (modified low fluctuating flow) as a baseline, followed by two years of a hydrograph characterized by spring and autumn spike flows, more extended, moderately high, steady spring flows to back up tributary mouths, and an extended summer period of low steady flows (called collectively the low steady summer flows [LSSF] test). In January 2000 Reclamation predicted the Upper Colorado River Basin would have an approximately 8.23 maf year. Reclamation provided the TWG with a provisional hydrograph similar to the LSSF to be completed as a "test of concept" for the experimental flow hydrograph portrayed by the Service in the biological opinion. A science plan was constructed under the auspices of GCMRC and research was conducted during much of 2000. In April 2001, GCMRC convened a science symposium that was largely directed at presentation of preliminary results from the LSSF research and monitoring. We are awaiting final reports from GCMRC.

The TWG has worked for an extended period to develop a program of experimental flows, including flows for native fish that would meet the needs of the biological opinion. Two ad hoc committees have been formed, and there have been numerous meetings and deliberations on this subject. The TWG Sediment Ad hoc Committee has produced a report with recommendations on flows to test sediment conservation hypotheses (Technical Work Group Ad-hoc Committee on Sediment 2001), and the AMWG has transferred the report to the Secretary of the Interior. The Experimental Flow Ad Hoc Committee has met several times with the Native Fish Work Group to discuss flow recommendations for native fish experiments, but no report has yet been produced.

STATUS OF ELEMENT 1.A

Ongoing. Although several experimental releases have been conducted under the auspices of the AMP, the program of experimental flows identified in the RPA is not yet completed. The longer than anticipated period for developing this program is attributable largely to its being made a part of the adaptive management process. Reclamation believes that the final program of flows will be much improved by the incorporation of scientific results from investigations conducted as part of the adaptive management program. Reclamation will strive to have a

complete program of experimental flows developed, and delivered to the AMWG by July 2002 for their consideration of a recommendation to the Secretary of the Interior. Dam releases from Glen Canyon Dam during 2001-2002 have followed the preferred alternative of the Glen Canyon Dam EIS to provide baseline measurements as recommended by Valdez and others (2000a). Funds have been sequestered within the AMP for augmentation of the research and monitoring necessary to measure the effects of future experimental flows.

ELEMENT 1.B

Reclamation shall implement a selective withdrawal program for Lake Powell waters and determine feasibility.

PROGRESS ON ELEMENT 1.B

Reclamation produced a draft environmental assessment on the proposed temperature control device (TCD) in January 1999. There were sufficient concerns evidenced during the review process that Reclamation decided to withdraw the assessment. One of the elements of the TCD assessment identified as lacking in the review process was a science plan to evaluate effects of the TCD. In October 1999, GCMRC produced a draft science plan for review by the TWG (GCMRC 1999). In November 1999, Reclamation convened a workshop to discuss TCD issues and to further develop the research and monitoring plan to assess TCD effects. A workshop attended by invited experts was held in January 2001 to further develop potential operational scenarios and the research and monitoring plan. Results of these workshops were communicated through the Upper Colorado Region's web site (<http://www.uc.usbr.gov>) and through presentations to the TWG and AMWG. Reclamation is in the process of conducting a survey of operators of dams having selective withdrawal devices, including TCDs, to determine whether concerns evidenced by scientists and managers for effects of the Glen Canyon Dam TCD have been experienced at other facilities. Results of this survey and other related investigations will be presented to the AMWG at their July 2002 meeting. The AMWG will be asked to make a recommendation on whether it is feasible and warranted to produce a preferred alternative for construction and operation as a test of the device's effects on aquatic resources in the Colorado River.

STATUS OF ELEMENT 1.B

Ongoing. Reclamation expects to complete the feasibility evaluation for the temperature control device in autumn 2002. If the decision is made to pursue construction and testing of a TCD, a new draft environmental assessment will be issued accompanied by a science plan to measure effects of the TCD.

ELEMENT 1.C

Determine responses of native fishes in Grand Canyon to various temperature regimes and river flows of the experimental flows and other operations of Glen Canyon Dam.

PROGRESS ON ELEMENT 1.C

Robinson and others (1998) considered implications of larval native fish drift from the LCR into perennially cold mainstem waters. Clarkson and Childs (2000) investigated the effects of different water temperatures on growth, development, and physiology of larval and early juvenile life stages of native Colorado River fishes. Robinson and Childs (2001) compared projected

growth rates in the seasonally warm LCR and the perennially cold mainstem. Trammel and others (*in preparation*) have investigated responses of native fishes to the experimental flows of year 2000. Hoffnagle (2000), Hoffnagle and others (2000), and Cole and others (2001) have produced reports on distribution and environmental needs of parasites of native and non-native fish in Grand Canyon, including the endangered humpback chub. A compilation of these reports has been submitted for publication and is in review (Hoffnagle and others *in review*).

One of the impediments to identifying responses of native fish to changes in water temperature regimes and river flows has been the lack of a consistent monitoring plan and assessment analysis. Under the auspices of GCMRC, with the aid of Dr. Carl Walters, University of British Columbia, a stock assessment model has been developed and is being applied to both humpback chub and flannelmouth sucker. The stock assessment approach concentrates on changes in the number of individuals recruiting to the populations of native fishes, which for humpback chub is ages 3-4. Preliminary results of this work, recently presented by GCMRC, indicate that the number of recruiting individuals to the LCR population of humpback chub declined from 1993-1999, the most recent year for which they have estimates (Coggins and Walters 2001).

STATUS OF ELEMENT 1.C

Ongoing. Research and monitoring of native fishes in Grand Canyon, as well as their predators, competitors, diseases, and parasites is being carried out largely under the auspices of the GCMRC with funding provided to the GCDAMP. Research and monitoring work accomplished through GCMRC is accomplished through competitive proposals that are peer-reviewed by independent scientists. Results of this work are presented on a regular basis at TWG and AMWG meetings, and are published as peer-reviewed articles in technical journals.

ELEMENT 2

Protect humpback spawning population and habitat in the Little Colorado River (LCR) by being instrumental in developing a management plan for this river.

PROGRESS ON ELEMENT 2

In Reclamation's response to the Service's 1994 biological opinion on operation of Glen Canyon Dam, we agreed to assist the Navajo Nation and other entities having authority and jurisdiction to fund and implement the management plan. We contracted with the Navajo Nation to develop a management plan, because of the Nation's ownership of much of the lower reach of the LCR and the large percentage of the basin that lies within their boundaries. The Navajo Nation subsequently contracted with SWCA, Inc. to develop the plan. That contract expired during the transition from GCS to GCMRC, so a new cooperative agreement was finalized and a draft report was issued in November 1998. The Service reviewed the report and provided their comments in a June 8, 1999, letter to Dr. Richard Valdez of SWCA. In that letter the Service requested Reclamation to state more clearly what was intended in our response to the Service's biological opinion with the statement "We will continue to work cooperatively with those entities having authority and jurisdiction to fund and implement the (LCR management) plan." We will now clarify our meaning in this sentence.

Reclamation does not have the authority or the responsibility to implement the LCR management plan. Indeed, no single agency or entity has the authority or responsibility to implement a management plan that would protect the endangered humpback chub and its

critical habitat from threats arising throughout the basin. Watershed management, by its very nature, must be carried out as a cooperative effort among government agencies and other entities that have authorities and responsibilities for resources in the watershed area. We have agreed to cooperate with those entities having the appropriate authority and jurisdiction in their efforts to fund and implement the plan, and to participate in an appropriate organization to carry out the plan.

After the Service reviewed the draft SWCA plan in 1999, it was revised and divided into a draft management plan and a supplemental report. Subsequently, SWCA has experienced a change in ownership, the lead author, Dr. Valdez, is no longer employed by the company, and the contract for the work has expired. SWCA finalized the supplemental report, but the management plan has not been completed.

Reclamation recently made a presentation to the Little Colorado River Multi-Objective Management watershed group (LCR-MOM) on the need for a LCR management plan for humpback chub and our efforts in that endeavor. The LCR-MOM is an umbrella watershed group having as members LCR basin subwatershed groups, Native American tribes, and city, county, state, and federal agencies. At the meeting LCR-MOM representatives indicated that they are interested in partnering with Reclamation and the Service in the development of the management plan. In subsequent conversations with Ecological Services staff we have confirmed that the Service also is supportive of this approach. Therefore, we have agreed to work with the Service, LCR-MOM and other watershed entities in developing a management plan, which will meet Reclamation's commitment for this element of the biological opinion. Reclamation anticipates that the plan can be completed by the end of June 2003, and we will work with other drafters of the plan to meet that deadline.

STATUS OF ELEMENT 2

Ongoing. Reclamation is working with the Service, LCR-MOM and other watershed entities to develop a management plan that will satisfy this element of the RPA. The plan will be developed cooperatively and completed by the end of June 2003, thereby completing Reclamation's responsibility under this element of the RPA.

ELEMENT 3

Develop actions that will help ensure the continued existence of the razorback sucker by first sponsoring a workshop within one year following the biological opinion. Following review of the workshop results, the Service will recommend a course of action and develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

PROGRESS ON ELEMENT 3

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. The results of the workshop were sent to participants, including the Service, on February 12, 1996. The Service has not initiated development of the Memorandum of Understanding for razorback sucker management. In the Service's response to Reclamation's last progress evaluation, dated May 27, 1999, several action items of interest to the Service were identified. Because the only known extant population of razorback sucker above Hoover Dam is in Lake Mead, we believe these actions should be addressed primarily by the Lower Colorado Region Reclamation office. However, we are partially addressing two of the actions—

non-native fish control and provision of experimental flows that could affect habitat of razorback sucker in upper Lake Mead—through the AMP.

STATUS OF ELEMENT 3

Ongoing. Reclamation has completed the workshop, which was the first step for this element. It is our understanding that the next step for satisfying this element is for the Service to recommend a course of action and to develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

ELEMENT 4

Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

PROGRESS ON ELEMENT 4

Development of environmental conditions that would allow successful reproduction by humpback chub in the Colorado River below Glen Canyon Dam is associated with efforts to assess the feasibility of a temperature control device and the testing of flow regimes for native fishes. In December 2000, GCMRC received a final report from Valdez and others (2000b) providing recommendations on the establishment of a second population of humpback chub in Grand Canyon. The authors evaluated four alternatives: (1) existing mainstem aggregation, (2) metapopulation approach, (3) tributaries, and (4) tributary and mainstem. They concluded that:

The primary criteria for establishing a second population of humpback chub in Grand Canyon are (1) establishing successfully reproducing adults of sufficient number to maintain the maximum genetic viability of the species and (2) achieving long-term demographic stability in suitable habitat reasonably protected from threats and catastrophes. Preliminary habitat analyses show that genetic criteria (i.e., target population size and structure) are unlikely to be met in a tributary, but may be met in two contiguous aggregations (Stephen Aisle/Middle Granite Gorge) or in the mainstem taken as a whole (the metapopulation concept, which assumes sub-populations periodically exchange individuals and, hence, are linked genetically). The metapopulation concept is thought to present the greatest likelihood for success in establishing a new, genetically viable population of humpback chub in Grand Canyon.

The authors identified several prerequisites to enhance the probability of success for a reproducing mainstem population. First, they identified that mainstem water would need to be sufficiently warmed by implementation of the proposed temperature control device on Glen Canyon Dam. They were clear, however, that this finding should not be construed as a recommendation by them for that implementation. Second, the authors proposed that a non-native fish control program must be an important consideration before attempting to establish a second population. Third, they recommended that a formal, standardized fish monitoring program be in place and gathering data for at least one year before establishment of the second population is attempted.

STATUS OF ELEMENT 4

Ongoing. Investigations and actions are in progress to satisfy prerequisites to establishment of a second population as identified by Valdez and others (2000b). As indicated above, under

element 1b, Reclamation intends to make a determination on feasibility of the TCD for Glen Canyon Dam in 2002. Proposals presently are under consideration for control of brown trout in Bright Angel Creek and Reclamation is funding an evaluation of sampling gear for capture of channel catfish and carp in the Little Colorado River. The use of Glen Canyon Dam releases to negatively impact non-native fish, in addition to directly improving habitat for native fish, has been investigated and is being incorporated into the development of a program of experimental flows to satisfy the needs of element 1a. GCMRC also is conducting an investigation of the genetics of humpback chub aggregations in Grand Canyon to determine the extent of genetic relatedness among the aggregations. This work, which will be completed in 2002, is very important in determining whether the aggregations can be considered a single population. Results from this work could have significant effects on the selected approach to establishing a second spawning aggregation of humpback chub in Grand Canyon.

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United States Department of the Interior

BUREAU OF RECLAMATION

Upper Colorado Regional Office
125 South State Street, Room 6107
Salt Lake City, Utah 84138-1102



IN REPLY REFER TO:

UC-735
ENV-7.00

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service
2321 W. Royal Palm Road, Suite 103, Phoenix, AZ 85021-4961

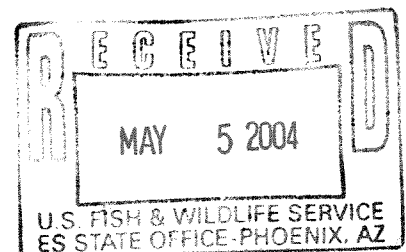
From: Rick L. Gold
Regional Director

Subject: Implementation Status of the Elements of the Reasonable and Prudent
Alternative from the December 21, 1994, Biological Opinion on the Operations
of Glen Canyon Dam

A detailed description of the status of each element of the referenced Reasonable and Prudent Alternative (RPA) is attached. We appreciate the willingness of your staff to work with us in completing this assessment. Dennis Kubly of our Environmental Resources Division will serve as point-of-contact for coordination of RPA activities. Please contact him at 801-524-3715 if you have any questions.

Attachments

cc: Regional Director, U.S. Fish and Wildlife Service, Fish and Wildlife Enhancement,
P.O. Box 1306, 500 Gold Avenue, Albuquerque, NM 87103
Chief, Grand Canyon Monitoring and Research Center, 2255 Gemini Drive, Room
341, Flagstaff, AZ 86001
Members of the AMWG and TWG (see attached mailing list)
Regional Director, Salt Lake City, UT
Attn: UC-100, -115, -438, -600, -700, -702, -720, (w/att to each)



2002-2003 PROGRESS REVIEW IMPLEMENTATION OF THE GLEN CANYON DAM OPERATIONS BIOLOGICAL OPINION

This is Reclamation's fifth progress report for implementation of the Reasonable and Prudent Alternative (RPA) for the 1994 Glen Canyon Dam Operations Biological Opinion. It addresses activities completed during calendar years 2002-2003. Each review has included at least one preliminary communication between the staffs of the Bureau of Reclamation (Reclamation) and the U.S. Fish and Wildlife Service (Service). The first progress report was prepared on November 27, 1996, and the Service formally responded on April 3, 1997. The second report was issued on December 12, 1997. No formal response was received from the Service. The third report was sent on February 25, 1999, and the Service responded on May 27, 1999. The fourth report was delivered on May 8, 2002 and the Service responded on June 13, 2002.

At the close of calendar year 2003, five of the seven elements of the biological opinion are in progress, with one item completed and another awaiting follow-up action by the Service.

Following is a discussion of each element.

ELEMENT 1

Reclamation shall develop an adaptive management program.

PROGRESS ON ELEMENT 1

The Glen Canyon Dam Adaptive Management Program (GCDAMP) retains the same organizational structure as presented in the fourth sufficient progress communication. The GCDAMP Charter was renewed in 2003. New and continuing representatives to the Adaptive Management Work Group (AMWG) were confirmed by the Secretary of the Interior during 2002-2003; the Federation of Fly Fishers replaced Trout Unlimited and Grand Canyon Wildlands Council replaced Southwest Rivers. One new Protocol Evaluation Panel, on topographic survey protocols (Saleh and others 2003), was convened in 2002-2003.

In response to a discovery that the endangered humpback chub (HBC) population in Grand Canyon was in decline, the AMWG directed in January 2003 that an ad hoc committee be formed with the responsibility of developing a comprehensive plan for future research, monitoring, and management of the endangered fish. In August 2003, the HBC Ad Hoc Committee delivered the plan to the AMWG (Humpback Chub Ad Hoc Committee 2003), and projects identified in the plan are to be funded in both the 2004 and 2005 fiscal years. The Science Advisory Board subsequently provided a review of the comprehensive management plan (Glen Canyon Dam AMP Science Advisors 2003). The Science Advisory Board also reviewed the feasibility of a temperature control device on Glen Canyon Dam for the purpose of improving habitat conditions for humpback chub in the mainstem Colorado River (Garrett and others 2003). Results of science investigations conducted under the auspices of the GCDAMP were presented at a science symposium on October 28-30, 2003, and are available at http://www.gcmrc.gov/symposium/2003/sym_after/symposium.html.

A very important step in developing an ecosystem-based science program has been the development of a conceptual model of the Colorado River ecosystem in the Grand Canyon region (Walters and others 2000). During 2003 the TWG used knowledge gained from the conceptual model to evaluate a program of potential future experimental actions through a multi-attribute tradeoff analysis (Failing and others 2003). A complimentary exercise has been the development of the GCDAMP Strategic Plan, which was adopted by the AMWG and is available at http://www.usbr.gov/uc/envprog/amp/strategic_plan.html.

STATUS OF ELEMENT 1

Completed. The GCDAMP has been developed and implemented.

ELEMENT 1.A

Carry out a program of experimental flows, including high steady flows in the spring and low steady flows in summer and fall during approximately 8.23 million acre foot (maf) water years. The RPA set forth a schedule for development and implementation of experimental flows. Design of experimental flows and associated studies were to have been completed by October 1996. Unless the Service doubted the validity of the study design or the ability of the flow to contribute to removal of jeopardy, the flows were to be implemented in April 1997. The flows could begin even later in 1997, if good faith effort to make sufficient progress was completed. Absent sufficient progress, flows were to be implemented in spring of 1998.

PROGRESS ON ELEMENT 1.A

In January 2002 the AMWG directed the Grand Canyon Monitoring and Research Center (GCMRC), in consultation with the Technical Work Group (TWG), to design an experiment to test how dam operations might be modified and other management actions taken to better conserve sediment and help native fish. On March 25, 2002, the GCMRC provided a draft proposal for the requested experimental flows and management actions that formed the basis of the September 2002 Environmental Assessment on Proposed Experimental Releases from Glen Canyon Dam and Removal of Non-Native Fish (USDI 2002). Following the release of the Environmental Assessment, Section 7 consultation with the Service was initiated. Subsequently, the Service concurred with the finding that the proposed action would not adversely affect the southwestern willow flycatcher, the California condor, the razorback sucker, or critical habitat for the razorback sucker. The Service also found that the proposed activities would not likely result in jeopardy to the humpback chub, Kanab ambersnail, or bald eagle, or the destruction or adverse modification of critical habitat for the humpback chub (Service 2002). In December 2002, Reclamation and others (Bureau of Reclamation and others 2002) issued a Finding of No Significant Impact related to activities proposed for the experimental releases from Glen Canyon Dam and removal of non-native fish. Also in December 2002, Reclamation implemented conservation measures for Kanab ambersnail and humpback chub in conjunction with the proposed activities (Peterson 2002). Reclamation reinitiated Section 7 consultation in March 2003 (Peterson 2003) to propose a change in the size of humpback chubs translocated as part of the management activities detailed in the Environmental Assessment of 2002 (USDI 2002). The Service (2003a) responded with a finding of no jeopardy to the proposed changes. A Finding of No Significant Impact was made in July 2003 by

Reclamation and others (Bureau of Reclamation and others 2003) on a proposed modification to remove non-native fish from the Colorado River in an expanded area downstream of the confluence with the Little Colorado River. The Service (2003b) concurred with a finding of no jeopardy on the expanded non-native fish action in August 2003. Activities to remove non-native fish from the expanded area (river mile 56.2 to 72.7) were thus incorporated into future non-native removal efforts (Coggins and others 2002).

Implicit in the experimental flows and mechanical removal proposed action is the recognition that modification of dam operations alone likely is insufficient to achieve objectives of the GCDAMP, which include removal of jeopardy from humpback chub and razorback sucker. Mechanical removal of non-native fish from the Colorado River above and below the LCR was started in January 2003 (Coggins and others 2002, Coggins and Yard 2003) and is continuing in 2004. Non-native suppression releases from Glen Canyon Dam were implemented from January to March 2003 to test the effectiveness of high fluctuating flows on limiting the recruitment of non-native fish (Davis and Batham 2003, Korman and others 2003). The high fluctuating flows for non-native suppression also are being continued in 2004. Rogers and others (2003a) evaluated the abundance and distribution of non-native salmonids related to the mechanical removal efforts.

In October 2003, GCMRC convened a science symposium that was largely directed at presentation of results from the low summer steady flows (LSSF) research and monitoring. The results of this work are available at http://www.gcmrc.gov/symposium/2003/sym_after_symposium.html. Trammel and others (2002) and Korman and others (2003) reported on the effects of experimental flows on HBC.

STATUS OF ELEMENT 1.A

Ongoing. Although several experimental releases have been conducted under the auspices of the GCDAMP, the program of experimental flows identified in the RPA is not yet completed. The longer than anticipated period for developing this program is attributable largely to its being made a part of the adaptive management process. Reclamation believes that the long-term experimental plan being developed as part of the GCDAMP, which will include a program of experimental flows as required by this element of the RPA, will be much improved by the incorporation of scientific results from investigations conducted as part of the adaptive management program. A draft of the long-term experimental plan is due to be delivered to AMWG by August 2004 and a completed plan has been requested by January 2005 with compliance to be completed by July 2005. As indicated, the long-term experimental plan will include actions other than experimental releases from Glen Canyon Dam. Other components being discussed include the proposed temperature control device, mechanical removal of non-native fishes in the Colorado River and selected tributaries, translocation of endangered humpback chub to tributaries following non-native fish suppression, and turbidity/sediment augmentation.

As part of the conservation measures agreed to by the federal action agencies, the Service is engaged in HBC translocation efforts in the LCR above Chute Falls on the Navajo Reservation (Stone and Sponholtz, 2003). Subsequent monitoring of the translocated fish occurred in October 2003 with additional monitoring planned for spring 2004. If this experiment is successful, it may provide a viable action for expanding

humpback chub distribution within the LCR and lead the way to similar actions in other tributaries. Currently, non-native removal is occurring in Bright Angel Creek (Leibfried and others 2003) and the feasibility of extending this work to other tributaries to the Colorado River in Grand Canyon National Park (GCNP) is being investigated by NPS. If non-native removal is successful and suitable, additional translocations can be contemplated. Moving young HBC to other tributaries as *in-situ* refugia would decrease the risk of catastrophic events to the LCR HBC population and allow opportunities for translocated HBC to grow prior to migrating to the mainstream.

ELEMENT 1.B

Reclamation shall implement a selective withdrawal program for Lake Powell waters and determine feasibility.

PROGRESS ON ELEMENT 1.B

Reclamation has continued to work on the feasibility assessment since the decision was made to rescind the draft environmental assessment on the proposed temperature control device (TCD) released in January 1999. The TCD is often portrayed by fisheries biologists as likely the most important management tool for endangered fish in the Colorado River below Glen Canyon Dam, but also a tool that could have negative effects if mismanaged (Valdez and others 2003). In 2002, Reclamation conducted a survey of operators of dams having selective withdrawal devices, including TCDs, to determine whether concerns evidenced by scientists and managers for effects of the Glen Canyon Dam TCD have been experienced at other facilities. Results of this survey and other related investigations were presented to the AMWG at their July 2002 meeting and were subsequently published in Vermeyen (2003). No major environmental complications were identified in the survey results. In summer 2002, the AMWG recommended that Reclamation should solicit a risk assessment of the Glen Canyon Dam TCD proposal from the GCDAMP Science Advisors. Subsequently, the Advisors produced a report on their findings of risk assessment (Garrett and others 2003) which recommended the installation of a TCD for Glen Canyon Dam as soon as possible and the construction of a pilot TCD in the interim. The Science Advisors further recommended a strong leadership role from AMWG, TWG, and GCMRC related to the installation and operation of a TCD along with a commitment from all parties to incorporating the TCD into the GCDAMP and the research required to evaluate the TCD's effects. At the August 13-14, 2003 meeting, the AMWG recommended to the Secretary of the Interior that Reclamation should initiate environmental compliance associated with the construction of a TCD. Reclamation has moved forward with that action and has concurrently initiated a feasibility-level construction design assessment for the TCD.

Ask for
Vermeyen paper

STATUS OF ELEMENT 1.B

Ongoing. Following the results of scientific investigations, expert workshops, and a risk assessment, Reclamation advocates that the feasibility assessment requested by the Service has proceeded to the point where it is justified to develop environmental compliance documents to assess the potential effects of constructing and operating a TCD. If the decision is made to proceed, testing of the TCD would occur under the auspices of the GCDAMP using a science plan developed by GCMRC, cooperating scientists, and the Technical Work Group. Reclamation is proposing that the test of the TCD be accomplished by modifying two penstocks on Glen Canyon Dam and operating

the dam for a period of 3-4 years with assessment through the GCDAMP before a subsequent decision is made on further modification. Testing of the TCD would be the next phase in the feasibility assessment called for by the Service. The science plan will be completed and available for review in conjunction with the review of environmental compliance documents. Although many potential positive and negative effects of a TCD on endangered fish and other Colorado River resources have been postulated during investigations conducted to date, few of these projected outcomes can be known with certainty and thus testing through a research and monitoring program will be necessary to make these determinations.

Wopel!

ELEMENT 1.C

Determine responses of native fishes in Grand Canyon to various temperature regimes and river flows of the experimental flows and other operations of Glen Canyon Dam.

PROGRESS ON ELEMENT 1.C

Vernieu (2003) evaluated warming of mainstem and nearshore habitats during the low steady flows of summer 2000. Rogers and others (2003b) measured drift and benthic biomass under the low steady flows and powerplant-capacity spike flows in the LSSF experiment. Trammel and others (2003) investigated responses of native fishes to the same low steady and spike flows. A preliminary report on the mechanical removal of non-natives was submitted by Coggins and Yard (2003). Rogers and others (2003a) examined non-native salmonid distribution and abundance from RM 12 to 218. Johnstone and others (2003) reported on native fish monitoring efforts and made recommendations for approaches to setting up a standardized monitoring program.

Ask for Vernieu paper

One of the impediments to identifying responses of native fish to changes in water temperature regimes and river flows has been the lack of a consistent monitoring plan and assessment analysis. Under the auspices of GCMRC, with the aid of Dr. Carl Walters, University of British Columbia, a stock assessment model has been developed and is being applied to both humpback chub and flannelmouth sucker. The stock assessment approach concentrates on changes in the number of individuals recruiting to the populations of native fishes, which for humpback chub is ages 3-4. A recent compilation of results of this work indicates that the number of recruiting individuals to the LCR population of humpback chub declined from 1993-1999, the most recent year for which they have estimates (Coggins and others 2003). Concern within the GCDAMP arose over the controversy surrounding the different methods and models used to assess humpback chub populations in both the Upper Basin and in the Grand Canyon. In response to this concern, GCMRC convened a Panel of Independent Reviewers to meet with representatives of ongoing programs in the Upper Basin and Grand Canyon. The goal of this panel was to review current methods and make recommendations to improve the accuracy and precision associated with the parameter estimates (i.e., abundance, population growth rate, and recruitment) from the various models being used. The Panel of Independent Reviewers found that the competing models used in the Upper Basin and Grand Canyon were appropriate for their respective locations and made recommendations to improve their use in the future (Kitchell and others 2003). A series of meetings was proposed to examine data on humpback chubs collected in both the Upper Basin and in the Grand Canyon.

- What about concern et.?

STATUS OF ELEMENT 1.C

Ongoing. Research and monitoring of native fishes in Grand Canyon, as well as their predators, competitors, diseases, and parasites is being carried out largely under the auspices of the GCMRC with funding provided to the GCDAMP. Much of the research and monitoring work accomplished through GCMRC is accomplished through competitive proposals that are peer-reviewed by independent scientists. Results of this work are presented on a regular basis at TWG and AMWG meetings, and are published as reports and peer-reviewed articles in technical journals.

ELEMENT 2

Protect humpback spawning population and habitat in the Little Colorado River by being instrumental in developing a management plan for the Little Colorado River.

PROGRESS ON ELEMENT 2

Reclamation has stated previously that it does not have the authority or the responsibility to implement the LCR management plan. Indeed, no single agency or entity has the authority or responsibility to implement a management plan that would protect the endangered humpback chub and its critical habitat from threats arising throughout the basin. Watershed management, by its very nature, must be carried out as a cooperative effort among government agencies and other entities that have authorities and responsibilities for resources in the watershed area. We have agreed to cooperate with those entities having the appropriate authority and jurisdiction in their efforts to fund and implement the plan, and to participate in an appropriate organization to carry out the plan.

After the Service reviewed the draft SWCA Little Colorado River Management Plan in 1999, it was revised and divided into a draft management plan and a supplemental report. Subsequently, SWCA experienced a change in ownership, the lead author, Dr. Valdez, left the company, and the contract for the work expired. SWCA finalized the supplemental report (Valdez and Thomas 2001), but the management plan was not completed.

What can we do?

In March 2002, Reclamation made a presentation to the Little Colorado River Multi-Objective Management watershed group (LCR-MOM) on the need for a management plan for humpback chub and our efforts in that endeavor. The LCR-MOM is an umbrella watershed group having as members LCR basin subwatershed groups, Native American tribes, and city, county, state, and federal agencies. At the meeting, LCR-MOM representatives indicated that they were interested in partnering with Reclamation and the Service in the development of the management plan. In subsequent conversations with Ecological Services staff we confirmed that the Service also is supportive of this approach. Therefore, we have agreed to work with the Service, LCR-MOM and other watershed entities in developing a management plan, which will meet Reclamation's commitment for this element of the biological opinion.

STATUS OF ELEMENT 2

Ongoing. Reclamation is working with the Service, LCR-MOM and other watershed entities to develop a management plan that will satisfy this element of the RPA. Funding

for assisting in the development of an LCR management plan is contained in the 2005 GCDAMP budget recommended to the Secretary of the Interior by AMWG.

what do we need to do?

ELEMENT 3

Develop actions that will help ensure the continued existence of the razorback sucker by first sponsoring a workshop within 1 year following the biological opinion. Following review of the workshop results, the Service will recommend a course of action and develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

PROGRESS ON ELEMENT 3

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. The results of the workshop were sent to participants, including the Service, on February 12, 1996. The Service has not initiated development of the Memorandum of Understanding for razorback sucker management. In the Service's response to Reclamation's third progress evaluation, dated May 27, 1999, several action items of interest to the Service were identified. Because the only known extant population of razorback sucker above Hoover Dam is in Lake Mead (Holden and others 2000), we believe these actions should be addressed primarily by the Lower Colorado Region Reclamation office and members of the Lower Colorado River Multi-species Conservation Program. However, we are partially addressing two of the actions-non-native fish control and provision of experimental flows that could affect habitat of razorback sucker in upper Lake Mead-through the GCDAMP.

STATUS OF ELEMENT 3

Ongoing. Reclamation has completed the workshop, which was the first step for this element. It is our understanding that the next step for satisfying this element is for the Service to recommend a course of action and to develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

*but that what they said last time?
yes*

ELEMENT 4

Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

PROGRESS ON ELEMENT 4

Impediments to establishment of a second spawning aggregation of humpback chub in the Colorado River include unsuitable environmental conditions, e.g., water temperature, and the presence of non-native competitors and predators. As indicated above, under element 1b, Reclamation made a determination on feasibility of the TCD for Glen Canyon Dam in 2002 (Garrett and others 2003) and has initiated environmental compliance necessary for the construction and testing of a TCD at Glen Canyon Dam. Brown trout control in Bright Angel Creek and a feasibility assessment of non-native control in other tributaries are being done by GCNP (Leibfried and others 2003) and Reclamation funded a project conducted by the Arizona Game and Fish Department to evaluate sampling gear for capture of channel catfish and carp in the LCR. Rogers and others (2003a) evaluated the abundance and distribution of non-native predators related

to mechanical removal efforts. In 2003 the Service began a translocation program funded by Reclamation for humpback chub above Chute Falls in the LCR and GCNP is examining other tributaries to the Colorado River in the park to assess their suitability for translocations. Related to translocations, Paukert and others (in review) examined site fidelity of humpback chubs.

The use of Glen Canyon Dam releases to negatively impact non-native fish (Davis and Batham 2003, Korman and others 2003), in addition to directly improving habitat for native fish, has been incorporated into the development of a program of experimental flows to satisfy the needs of element 1a. Another impediment to establishment of a second spawning aggregation is the determination of genetic relatedness among aggregations of humpback chub in Grand Canyon. Valdez and Ryel (1995) established the presence of nine aggregations of humpback chub, including the individuals in the LCR. Genetic evaluations underway by Colorado State University (Douglas and Douglas 2003a, 2003b) on the entire taxon and by the Service on humpback chub collected in the LCR and held at Willow Beach National Fish Hatchery will provide important information in making these determinations. Both projects are scheduled to be completed in 2004.

STATUS OF ELEMENT 4

Ongoing. Investigations and actions are in progress to establish a second population of humpback chub as identified by Valdez and others (2000). Reclamation believes that, in the aggregate, all of these activities represent a system-wide approach at improving humpback chub viability throughout the Grand Canyon ecosystem.

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UC-735
ENV-7.00

Sept. 7, 2004

MEMORANDUM

To: Field Supervisor, U.S. Fish and Wildlife Service
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From: Rick L. Gold /s/ **Rick L. Gold**
Regional Director

Subject: Implementation Status of the Elements of the Reasonable and Prudent
Alternative from the December 21, 1994, Biological Opinion on the Operations of Glen
Canyon Dam

A detailed description of the status of each element of the referenced Reasonable and Prudent Alternative (RPA) is attached. We appreciate the willingness of your staff to work with us in completing this assessment. Dennis Kubly of our Environmental Resources Division will serve as point-of-contact for coordination of RPA activities. Please contact him at 801-524-3715 if you have any questions.

Attachments

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2002-2003 PROGRESS REVIEW
IMPLEMENTATION OF THE GLEN CANYON DAM OPERATIONS
BIOLOGICAL OPINION

This is Reclamation's fifth progress report for implementation of the Reasonable and Prudent Alternative (RPA) for the 1994 Glen Canyon Dam Operations Biological Opinion. It addresses activities completed during calendar years 2002-2003. Each review has included at least one preliminary communication between the staffs of the Bureau of Reclamation and the U.S. Fish and Wildlife Service (Service). The first progress report was prepared on November 27, 1996, and the Service formally responded on April 3, 1997. The second report was issued on December 12, 1997. No formal response was received from the Service. The third report was sent on February 25, 1999, and the Service responded on May 27, 1999. The fourth report was delivered on May 8, 2002 and the Service responded on June 13, 2002.

At the close of calendar year 2003, five of the seven elements of the biological opinion are in progress, with one item completed and another awaiting follow-up action by the Service.

Following is a discussion of each element.

ELEMENT 1

Reclamation shall develop an adaptive management program.

PROGRESS ON ELEMENT 1

The Glen Canyon Dam Adaptive Management Program (GCDAMP) retains the same organizational structure as presented in the fourth sufficient progress communication. The GCDAMP Charter was renewed in 2003. New and continuing representatives to the Adaptive Management Work Group (AMWG) were confirmed by the Secretary of the Interior during 2002-2003; the Federation of Fly Fishers replaced Trout Unlimited and Grand Canyon Wildlands Council replaced Southwest Rivers. One new Protocol Evaluation Panel, on topographic survey protocols (Saleh and others 2003), was convened in 2002-2003.

In response to a discovery that the endangered humpback chub (HBC) population in Grand Canyon was in decline, the AMWG directed in January 2003 that an ad hoc committee be formed with the responsibility of developing a comprehensive plan for future research, monitoring, and management of the endangered fish. In August 2003, the HBC Ad Hoc Committee delivered the plan to the AMWG (Humpback Chub Ad Hoc Committee 2003), and projects identified in the plan are to be funded in both the 2004 and 2005 fiscal years. The Science Advisory Board subsequently provided a review of the comprehensive management plan (Glen Canyon Dam AMP Science Advisors 2003). The Science Advisory Board also reviewed the feasibility of a temperature control device (TCD) on Glen Canyon Dam for the purpose of improving habitat conditions for HBC in the mainstem Colorado River (Baron and others 2003). Results of science investigations conducted under the auspices of the GCDAMP were presented at a science symposium on October 28-30, 2003, and are available at [online] http://www.gcmrc.gov/symposium/2003/sym_after/symposium.html.

A very important step in developing an ecosystem-based science program has been the development of a conceptual model of the Colorado River ecosystem in the Grand Canyon region (Walters and others 2000). During 2003 the TWG used knowledge gained from the conceptual model to evaluate a program of potential future experimental actions through a multi-attribute tradeoff analysis (Failing and others 2003). A complimentary exercise has been the development of the GCDAMP Strategic Plan, which was adopted by the AMWG and is available at [online] http://www.usbr.gov/uc/envprog/amp/strategic_plan.html.

STATUS OF ELEMENT 1

Completed. The GCDAMP has been developed and implemented.

ELEMENT 1.A

Carry out a program of experimental flows, including high steady flows in the spring and low steady flows in summer and fall during approximately 8.23 million acre foot (maf) water years. The RPA set forth a schedule for development and implementation of experimental flows. Design of experimental flows and associated studies were to have been completed by October 1996. Unless the Service doubted the validity of the study design or the ability of the flow to contribute to removal of jeopardy, the flows were to be implemented in April 1997. The flows could begin even later in 1997, if good faith effort to make sufficient progress was completed. Absent sufficient progress, flows were to be implemented in spring of 1998.

PROGRESS ON ELEMENT 1.A

In January 2002 the AMWG directed the Grand Canyon Monitoring and Research Center (GCMRC), in consultation with the Technical Work Group (TWG), to design an experiment to test how dam operations might be modified and other management actions taken to better conserve sediment and help native fish. On March 25, 2002, the GCMRC provided a draft proposal for the requested experimental flows and management actions that formed the basis of the September 2002 Environmental Assessment on Proposed Experimental Releases from Glen Canyon Dam and Removal of Non-Native Fish (USDI 2002). Following the release of the Environmental Assessment, Section 7 consultation with the Service was initiated. Subsequently, the Service concurred with the finding that the proposed action would not adversely affect the southwestern willow flycatcher, the California condor, the razorback sucker, or critical habitat for the razorback sucker. The Service also found that the proposed activities would not likely result in jeopardy to the HBC, Kanab ambersnail, or bald eagle, or the destruction or adverse modification of critical habitat for the humpback chub (Service 2002). In December 2002, Reclamation and others (Bureau of Reclamation and others 2002) issued a Finding of No Significant Impact related to activities proposed for the experimental releases from Glen Canyon Dam and removal of non-native fish. Also in December 2002, Reclamation implemented conservation measures for Kanab ambersnail and humpback chub in conjunction with the proposed activities (Peterson 2002). Reclamation reinitiated Section 7 consultation in March 2003 (Peterson 2003) to propose a change in the size of humpback chubs translocated as part of the management activities detailed in the Environmental Assessment of 2002 (USDI 2002). The Service (2003a) responded with a finding of no jeopardy to the proposed changes. A Finding of No Significant Impact was made in July 2003 by Reclamation and others (Bureau of Reclamation and others 2003) on a proposed modification to remove non-native fish from the Colorado River in an expanded area downstream of the confluence with the Little Colorado River (LCR). The Service (2003b) concurred with a finding of no jeopardy on the expanded non-native fish action in August 2003. Activities to remove non-native fish from the expanded area (river mile 56.2 to 72.7) were thus incorporated into future non-native removal efforts (Coggins and others 2002).

Implicit in the experimental flows and mechanical removal proposed action is the recognition that modification of dam operations alone likely is insufficient to achieve objectives of the GCDAMP, which include removal of jeopardy from HBC and razorback sucker. Mechanical removal of non-native fish from the Colorado River above and below the LCR was started in January 2003 (Coggins and others 2002, Coggins and Yard 2003) and is continuing in 2004. Non-native suppression releases from Glen Canyon Dam were implemented from January to March 2003 to test the effectiveness of high fluctuating flows on limiting the recruitment of non-native fish (Davis and Batham 2003, Korman and others 2003). The high fluctuating flows for non-native suppression also are being continued in 2004. Rogers and others (2003a) evaluated the abundance and distribution of non-native salmonids related to the mechanical removal efforts.

In October 2003, GCMRC convened a science symposium that was largely directed at presentation of results from the low summer steady flows (LSSF) research and monitoring. The results of this work are available at [online] http://www.gcmrc.gov/symposium/2003/sym_after/symposium.html. Trammel and others (2002) and Korman and others (2003) reported on the effects of experimental flows on HBC.

STATUS OF ELEMENT 1.A

Ongoing. Although several experimental releases have been conducted under the auspices of the GCDAMP, the program of experimental flows identified in the RPA is not yet completed. The longer than anticipated period for developing this program is attributable largely to its being made a part of the adaptive management process. Reclamation believes that the long-term experimental plan being developed as part of the GCDAMP, which will include a program of experimental flows as required by this element of the RPA, will be much improved by the incorporation of scientific results from investigations conducted as part of the adaptive management program. A draft of the long-term experimental plan is due to be delivered to AMWG by August 2004 and a completed plan has been requested by January 2005 with compliance to be completed by July 2005. As indicated, the long-term experimental plan will include actions other than experimental releases from Glen Canyon Dam. Other components being discussed include the proposed temperature control device, mechanical removal of non-native fishes in the Colorado River and selected tributaries, translocation of endangered HBC to tributaries following non-native fish suppression, and turbidity/sediment augmentation.

As part of the conservation measures agreed to by the federal action agencies, the Service is engaged in HBC translocation efforts in the LCR above Chute Falls on the Navajo Reservation (Stone and Sponholtz, 2003). Subsequent monitoring of the translocated fish occurred in October 2003 with additional monitoring planned for spring 2004. If this experiment is successful, it may provide a viable action for expanding HBC distribution within the LCR and lead the way to similar actions in other tributaries. Currently, non-native removal is occurring in Bright Angel Creek (Leibfried and others 2003) and the feasibility of extending this work to other tributaries to the Colorado River in Grand Canyon National Park (GCNP) is being investigated by National Park Service (NPS). If non-native removal is successful and suitable, additional translocations can be contemplated. Moving young HBC to other tributaries as *in-situ* refugia would decrease the risk of catastrophic events to the LCR HBC population and allow opportunities for translocated HBC to grow prior to migrating to the mainstream.

ELEMENT 1.B

Reclamation shall implement a selective withdrawal program for Lake Powell waters and determine feasibility.

PROGRESS ON ELEMENT 1.B

Reclamation has continued to work on the feasibility assessment since the decision was made to rescind the draft environmental assessment on the proposed temperature control device (TCD) released in January 1999. The TCD is often portrayed by fisheries biologists as likely the most important management tool for endangered fish in the Colorado River below Glen Canyon Dam, but also a tool that could have negative effects if mismanaged (Valdez and others 2003). In 2002, Reclamation conducted a survey of operators of dams having selective withdrawal devices, including TCDs, to determine whether concerns evidenced by scientists and managers for effects of the Glen Canyon Dam TCD have been experienced at other facilities. Results of this survey and other related investigations were presented to the AMWG at their July 2002 meeting and were subsequently published in Vermeyen (2003). No major environmental complications were identified in the survey results. In summer 2002, the AMWG recommended that Reclamation should solicit a risk assessment of the Glen Canyon Dam TCD proposal from the GCDAMP Science Advisors. Subsequently, the Advisors produced a report on their findings of risk assessment (Baron and others 2003) which recommended the installation of a TCD for Glen Canyon Dam as soon as possible and the construction of a pilot TCD in the interim. The Science Advisors further recommended a strong leadership role from AMWG, TWG, and GCMRC related to the installation and operation of a TCD along with a commitment from all parties to incorporating the TCD into the GCDAMP and the research required to evaluate the TCD's effects. At the August 13-14, 2003 meeting, the AMWG recommended to the Secretary of the Interior that Reclamation should initiate environmental compliance associated with the construction of a

TCD. Reclamation has moved forward with that action and has concurrently initiated a feasibility-level construction design assessment for the TCD.

STATUS OF ELEMENT 1.B

Ongoing. Following the results of scientific investigations, expert workshops, and a risk assessment, Reclamation advocates that the feasibility assessment requested by the Service has proceeded to the point where it is justified to develop environmental compliance documents to assess the potential effects of constructing and operating a TCD. If the decision is made to proceed, testing of the TCD would occur under the auspices of the GCDAMP using a science plan developed by GCMRC, cooperating scientists, and the Technical Work Group. Reclamation is proposing that the test of the TCD be accomplished by modifying two penstocks on Glen Canyon Dam and operating the dam for a period of 3-4 years with assessment through the GCDAMP before a subsequent decision is made on further modification. Testing of the TCD would be the next phase in the feasibility assessment called for by the Service. The science plan will be completed and available for review in conjunction with the review of environmental compliance documents. Although many potential positive and negative effects of a TCD on endangered fish and other Colorado River resources have been postulated during investigations conducted to date, few of these projected outcomes can be known with certainty and thus testing through a research and monitoring program will be necessary to make these determinations.

ELEMENT 1.C

Determine responses of native fishes in Grand Canyon to various temperature regimes and river flows of the experimental flows and other operations of Glen Canyon Dam.

PROGRESS ON ELEMENT 1.C

Vernieu (2003) evaluated warming of mainstem and nearshore habitats during the low steady flows of summer 2000. Rogers and others (2003b) measured drift and benthic biomass under the low steady flows and powerplant-capacity spike flows in the LSSF experiment. Trammel and others (2003) investigated responses of native fishes to the same low steady and spike flows. A preliminary report on the mechanical removal of non-natives was submitted by Coggins and Yard (2003). Rogers and others (2003a) examined non-native salmonid distribution and abundance from RM 12 to 218. Johnstone and others (2003) reported on native fish monitoring efforts and made recommendations for approaches to setting up a standardized monitoring program.

One of the impediments to identifying responses of native fish to changes in water temperature regimes and river flows has been the lack of a consistent monitoring plan and assessment analysis. Under the auspices of GCMRC, with the aid of Dr. Carl Walters, University of British Columbia, a stock assessment model has been developed and is being applied to both HBC and flannelmouth sucker. The stock assessment approach concentrates on changes in the number of individuals recruiting to the populations of native fishes, which for humpback chub is ages 3-4. A recent compilation of results of this work indicates that the number of recruiting individuals to the LCR population of HBC declined from 1993-1999, the most recent year for which they have estimates (Coggins and others 2003). Concern within the GCDAMP arose over the controversy surrounding the different methods and models used to assess humpback chub populations in both the Upper Basin and in the Grand Canyon. In response to this concern, GCMRC convened a Panel of Independent Reviewers to meet with representatives of ongoing programs in the Upper Basin and Grand Canyon. The goal of this panel was to review current methods and make recommendations to improve the accuracy and precision associated with the parameter estimates (i.e., abundance, population growth rate, and recruitment) from the various models being used. The Panel of Independent Reviewers found that the competing models used in the Upper Basin and Grand Canyon were appropriate for their respective locations and made recommendations to improve their use in the future (Kitchell and others 2003). A series of meetings was proposed to examine data on humpback chubs collected in both the Upper Basin and in the Grand Canyon.

STATUS OF ELEMENT 1.C

Ongoing. Research and monitoring of native fishes in Grand Canyon, as well as their predators, competitors, diseases, and parasites is being carried out largely under the auspices of the GCMRC with funding provided to the GCDAMP. Much of the research and monitoring work accomplished through GCMRC is accomplished through competitive proposals that are peer-reviewed by independent scientists. Results of this work are presented on a regular basis at TWG and AMWG meetings, and are published as reports and peer-reviewed articles in technical journals.

ELEMENT 2

Protect humpback spawning population and habitat in the LCR by being instrumental in developing a management plan for the Little Colorado River.

PROGRESS ON ELEMENT 2

Reclamation has stated previously that it does not have the authority or the responsibility to implement the LCR management plan. Indeed, no single agency or entity has the authority or responsibility to implement a management plan that would protect the endangered humpback chub and its critical habitat from threats arising throughout the basin. Watershed management, by its very nature, must be carried out as a cooperative effort among government agencies and other entities that have authorities and responsibilities for resources in the watershed area. We have agreed to cooperate with those entities having the appropriate authority and jurisdiction in their efforts to fund and implement the plan, and to participate in an appropriate organization to carry out the plan.

After the Service reviewed the draft SWCA Little Colorado River Management Plan in 1999, it was revised and divided into a draft management plan and a supplemental report. Subsequently, SWCA experienced a change in ownership, the lead author, Dr. Valdez, left the company, and the contract for the work expired. SWCA finalized the supplemental report (Valdez and Thomas 2001), but the management plan was not completed.

In March 2002, Reclamation made a presentation to the Little Colorado River Multi-Objective Management watershed group (LCR-MOM) on the need for a management plan for humpback chub and our efforts in that endeavor. The LCR-MOM is an umbrella watershed group having as members LCR basin subwatershed groups, Native American tribes, and city, county, state, and federal agencies. At the meeting, LCR-MOM representatives indicated that they were interested in partnering with Reclamation and the Service in the development of the management plan. In subsequent conversations with Ecological Services staff we confirmed that the Service also is supportive of this approach. Therefore, we have agreed to work with the Service, LCR-MOM and other watershed entities in developing a management plan, which will meet Reclamation's commitment for this element of the biological opinion.

STATUS OF ELEMENT 2

Ongoing. Reclamation is working with the Service, LCR-MOM and other watershed entities to develop a management plan that will satisfy this element of the RPA.

Funding for assisting in the development of an LCR management plan is contained in the 2005 GCDAMP budget recommended to the Secretary of the Interior by AMWG.

ELEMENT 3

Develop actions that will help ensure the continued existence of the razorback sucker by first sponsoring a workshop within one year following the biological opinion. Following review of the workshop results, the Service will recommend a course of action and develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

PROGRESS ON ELEMENT 3

Reclamation sponsored a workshop on the endangered razorback sucker on January 11 and 12, 1996. The results of the workshop were sent to participants, including the Service, on February 12, 1996. The Service has not initiated development of the Memorandum of Understanding for razorback sucker management. In the Service's response to Reclamation's third progress evaluation, dated May 27, 1999, several action items of interest to the Service were identified. Because the only known extant population of razorback sucker above Hoover Dam is in Lake Mead (Holden and others 2000), we believe these actions should be addressed primarily by the Lower Colorado Region Reclamation office and members of the Lower Colorado River Multi-species Conservation Program. However, we are partially addressing two of the actions-non-native fish control and provision of experimental flows that could affect habitat of razorback sucker in upper Lake Mead-through the GCDAMP.

STATUS OF ELEMENT 3

Ongoing. Reclamation has completed the workshop, which was the first step for this element. It is our understanding that the next step for satisfying this element is for the Service to recommend a course of action and to develop a Memorandum of Understanding with Reclamation and other entities who may wish to participate.

ELEMENT 4

Establish a second spawning aggregation of humpback chub downstream of Glen Canyon Dam.

PROGRESS ON ELEMENT 4

Impediments to establishment of a second spawning aggregation of humpback chub in the Colorado River include unsuitable environmental conditions, e.g., water temperature, and the presence of non-native competitors and predators. As indicated above, under element 1b, Reclamation made a determination on feasibility of the TCD for Glen Canyon Dam in 2002 (Baron and others 2003) and has initiated environmental compliance necessary for the construction and testing of a TCD at Glen Canyon Dam. Brown trout control in Bright Angel Creek and a feasibility assessment of non-native control in other tributaries are being done by GCNP (Leibfried and others 2003) and Reclamation funded a project conducted by the Arizona Game and Fish Department to evaluate sampling gear for capture of channel catfish and carp in the LCR. Rogers and others (2003a) evaluated the abundance and distribution of non-native predators related to mechanical removal efforts. In 2003 the Service began a translocation program funded by Reclamation for humpback chub above Chute Falls in the LCR and GCNP is examining other tributaries to the Colorado River in the park to assess their suitability for translocations. Related to translocations, Paukert and others (in review) examined site fidelity of humpback chubs.

The use of Glen Canyon Dam releases to negatively impact non-native fish (Davis and Batham 2003, Korman and others 2003), in addition to directly improving habitat for native fish, has been incorporated into the development of a program of experimental flows to satisfy the needs of element 1a. Another impediment to establishment of a second spawning aggregation is the determination of genetic relatedness among aggregations of humpback chub in Grand Canyon. Valdez and Ryel (1995) established the presence of nine aggregations of humpback chub, including the individuals in the LCR. Genetic evaluations underway by Colorado State University (Douglas and Douglas 2003a, 2003b) on the entire taxon and by the Service on humpback chub collected in the LCR and held at Willow Beach National Fish Hatchery will provide important information in making these determinations. Both projects are scheduled to be completed in 2004.

STATUS OF ELEMENT 4

Ongoing. Investigations and actions are in progress to establish a second population of humpback chub as identified by Valdez and others (2000). Reclamation believes that, in the aggregate, all of

these activities represent a system-wide approach at improving humpback chub viability throughout the Grand Canyon ecosystem.

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