TECHNICAL WORK GROUP AD HOC COMMITTEE REVIEW OF AQUATIC PEP RECOMMENDATIONS REPORT

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The Technical Work Group Aquatic Protocol Evaluation Panel Review Ad hoc Committee (Ad hoc) was very impressed with the Aquatic Protocol Evaluation Panel's (PEP) knowledge and background and we greatly appreciate their efforts. We encourage continued efforts to bring fresh ideas into the Glen Canyon Dam Adaptive Management Program (GCDAMP), and we applaud the Grand Canyon Monitoring and Research Center's (GCMRC) efforts to continue these reviews. Hopefully, the use of PEPs will be an ongoing process and continue to help the GCDAMP in improving the program's research and monitoring efforts.

The PEP report authored by Anders and others (2001)[1] contains recommendations and comments directed at six major programmatic areas in the aquatic program. These areas are (1) establishment of a water quality program (2) conducting a critical review of the food base program (3) expansion of research and monitoring for humpback chub (4) development of a monitoring plan for other native fish (5) extension of exotic fish monitoring to nonsalmonid species and (6) program management.

The process engaged in by the Ad hoc followed that agreed to by the Technical Work Group (TWG) at their March 14-15, 2001, meeting. In this process GCMRC responds to the PEP recommendations and the TWG subsequently reviews both the PEP report and GCMRC responses and provides concurrence or other recommendations. GCMRC then develops revised long-term and annual plans based on TWG comments. If necessary, GCMRC seeks additional feedback from the PEP chair in addressing TWG comments. Finally, GCMRC and the TWG make joint recommendations for revised research and monitoring plans to the AMWG.

Establish a Water Quality Program

PEP Recommendation: A water quality program that monitors physical and biological parameters of the Colorado River in Grand Canyon should be established. This program could be tied to physical sampling sites at non-boat access points associated with USGS gauging stations.

GCMRC General Response: GCMRC generally agrees with this recommendation. However we are moving at a deliberate pace which parallels our revision of the IWQP as well as changes in our foodbase monitoring and research program. We want water quality measurements and programs to be linked in a meaningful way to other elements of our program, including physical resources.

Ad hoc Response: The Ad hoc agrees that a comprehensive water quality program needs to be defined and implemented, and that this program should be linked to the physical, food base, and fisheries sampling. We also agree that the reservoir water quality sampling should not stand alone, but rather be linked to that of the downstream Grand Canyon ecosystem, and that the

primary emphasis for water quality should be downstream as identified by the earlier Integrated Water Quality Protocol Evaluation Panel. It is important to learn the characteristics, variability and effects of the medium we seek to understand. It is also important to understand the limits to which we can influence those characteristics and set priorities accordingly.

The water quality program should preferably go through similar data synthesis and analysis to that of fish program before we embark on a new long-term monitoring program. The committee thinks it would be helpful for GCMRC to provide results of these analyses to the TWG, including identification of variables being measured, detection limits, and precision of estimates expected from the planned frequency and intensity of sampling. This information will assist in any sequencing or prioritization necessary to meet future budgetary constraints should they arise.

The Ad hoc agrees with GCMRC that one impediment to identifying the variables to be measured in the water quality program is the lack of finalized management objectives and information needs. The PEP did identify some variables that they believed would be included in any water quality program. Among them were turbidity, water temperature, key nutrients, and carbon. They suggested beginning regular temporal sampling at the four physical program sites (Lee's Ferry, Paria River, Bright Angel Creek and Diamond Creek) and at the mouths of tributaries on at least a seasonal basis. It was not clear to the Ad hoc whether some water quality sampling at the four gaging sites already is being completed by USGS staff contracted to gather flow and sediment data at these sites.

GCMRC has initiated some water quality sampling, including forms of organic carbon in conjunction with collection of drift for the food base program, water temperature, and conductivity data, at the four fixed physical program sites. GCMRC identifies the carbon sampling as being pursuant to the development of a carbon budget, but it is not apparent whether the identified sampling regime includes necessary carbon inputs at Glen Canyon Dam and from tributaries. The Ad hoc notes that development of a carbon budget for the CRE undoubtedly would require much more extensive sampling, both temporally and spatially, than is presently being conducted by GCMRC. Also, it is not clear to us that the PEP intended this sampling to be more than part of the standard monitoring program. We request that GCMRC identify the necessary sampling and estimated cost to develop a carbon budget for the CRE so that the TWG can be advised of the cost of completing this task.

The PEP includes key nutrients as important water quality variables in their recommendation, but notes that these variables, forms of nitrogen and phosphorus, have in the past not been measured with sufficient resolution. The PEP notes that there are techniques available to measure nutrients at desired levels and recommends that they be initiated by GCMRC. GCMRC indicates that they will improve this sampling to the level of resolution advocated by the PEP, and the Ad hoc concurs with that response. As with other variables being measured in this program, the Ad hoc thinks it would be beneficial for GCMRC, as the science institution, to convey to the TWG, as the interface with the AMWG, the statistical power available for detecting spatial and temporal change in the proposed sampling design.

Conduct a Critical Review of the Foodbase Program

PEP Recommendation: The food base program needs to be critically reviewed because the current level of understanding about the linkages between lower trophic levels and food availability of native fishes is not adequate to interpret food base data in relation to the management goal. Lower trophic levels can also be used to monitor ecosystem changes. GCMRC needs to explicitly identify the goal of the food base program, determine what metrics to use to monitor the lower trophic levels, and decide what level of detection of change is required. Sufficient data and experience exists to design a program that meets the identified needs with appropriate power.

GCMRC General Response: GCMRC fully concurs with this recommendation and we are in the process of redesigning our foodbase monitoring. This process will likely evolve over the next two-three years and involve articulation with the IWQP and fisheries research and monitoring efforts. Level of taxonomic resolution and intensity of sampling as well as budget and program linkages will be considered.

Ad hoc Response: The PEP advocated this critical review because "the current level of understanding about the linkages between lower trophic levels and food availability of native fishes is not adequate to interpret food base data in relation to the management goal." The PEP also advised that "[s]ufficient data and experience exists to design a program that meets the identified needs with appropriate power." The Ad hoc is somewhat concerned that the PEP did not consider the Lee's Ferry reach in their analysis of foodbase data as those data are extensive and their inclusion may have affected the PEP's recommendations on this program.

The Ad hoc agrees that GCMRC should conduct the critical review of the foodbase program, including a power analysis to determine what detection limits can be realized with existing and proposed sampling designs. GCMRC indicates that they have already modified the sampling regime for benthic monitoring by increasing the number of benthic sites and the number of samples on hard substrates, while eliminating the sampling of pool habitats. This information was valuable to the Ad hoc, but it does not include how sampling sites are being selected, whether they are at fixed or random locations, whether the frequency and timing of sampling has changed, and what level of precision is anticipated with the prescribed sampling regime. Also, GCMRC indicates that they are evaluating data for the ability to determine a 5-year trend, but the experimental design for experimental flows presently under consideration is a blocked design that may not lend itself to measurement of 5-year trends. We advocate that GCMRC communicate to the TWG what statistical analyses they anticipate using to determine change in status or trend for measured variables and what power the tests will have for detecting change in these variables.

As identified by the PEP, one approach to ascertaining the energy sources from lower trophic levels actually incorporated into fish tissue is to use naturally occurring isotopes. Some work using this approach has already been accomplished in the Colorado River ecosystem. We understand GCMRC's hesitation in making additional commitments for funding isotope research, but at the same time we did not find a suggested approach in their response that can

identify the unknown linkages between the food base and fish bioenergetics. We advocate that GCMRC give further consideration to how these linkages can be determined.

The PEP identified that information on lower trophic levels in the AMP is treated for its value as regards food for fish, rather than as an indication of the health of the CRE. They noted that the use of algae and invertebrates as indicator species would require taxonomic identification at a level beyond that accomplished by monitoring in the present program. Recent discovery of the exotic New Zealand mudsnail suggests that additional emphasis on determining the identity of algae and invertebrates may well be warranted, particularly if, as now suspected, the species has been present for more than two years without being detected. The Ad hoc suggests that GCMRC should confer with Glen Canyon National Recreation Area and Grand Canyon National Park to determine whether these two Park Service units have a program for detecting invading exotic species. If such a detection system does not exist, the GCDAMP should determine through its information needs process whether this emphasis is important to the program. As indicated by the PEP, we concur that linkage to the water quality program would be important for any lower trophic levels indicators.

Expand the Research and Monitoring for Humpback Chub

PEP Recommendation: The PEP recommends that further work be conducted to develop a conceptual model of the metapopulation biology of chub in the GCE to provide a context for a long-term monitoring program. Consideration should be given to the inclusion of genetic concerns in the monitoring program. GCMRC needs to develop explicit linkages between the results of annual monitoring and the management goals to ensure that the monitoring programs produce results appropriate to review progress to the goals. The PEP supports the completion of the current review of existing data, and the development of population models as these programs will yield sufficient information to make decisions about sampling programs for chub.

GCMRC General Response: GCMRC has funded and awaits the results of both a genetic study and isotopic analysis of tributary stream systems which should help resolve the metapopulation and attendant management/monitoring questions associated with this. We are developing a biannual feedback process to TWG and AMWG on monitoring results.

Ad hoc Response: The Ad hoc committee supports the completion of the genetic study on humpback chub, particularly with the recent emphasis by the AMWG on establishing a refugium population and the continuing questions on genetic identity of mainstem aggregations. The metapopulation biology of Grand Canyon humpback chub is an issue that needs to be addressed as regards its genetic diversity and integrity. We also agree with the PEP that isotopic analyses could be very valuable in determining natal streams and, perhaps, in differentiating time spent by individuals in the mainstem and tributaries. The Ad hoc supports GCMRC's compilation and evaluation of historic data, and we look forward to hearing the results of this effort.

Much of GCMRC's effort in tracking humpback chub is directed at use of stock assessment for determining recruitment. Unfortunately this index can not be used until the fish are at the age of recruitment, which is age 3-4, and the fish will suffer varying mortality to this age under a variety of flow regimes. The PEP recognized this difficulty in the context of assessing effects of

dam operations on fish at the age of recruitment when those operations varied annually. In related advice, the PEP advocated that GCMRC reanalyze the backwater (early life stage) fish data with the express goal of evaluating the utility of this information as a real-time recruitment index. The Ad hoc supports the PEP's recommendations that data on early life stages of native fish in mainstem rearing habitats should be reanalyzed, and we advocate that GCMRC should provide or present that analysis to the TWG for its consideration.

Develop a Monitoring Plan for other Native Fish

PEP Recommendation: The PEP was concerned that there no plan for monitoring the status of the 3 other extant native fish of the GCE. The PEP supports the ongoing synthesis of existing information and attempts to develop a population model for flannelmouth sucker as the first steps for developing a program for this species. GCMRC should develop explicit linkages between management goals and monitoring programs, and once all available data for the non-native species have been assembled, review options for monitoring these species.

GCMRC General Response: GCMRC shares this concern but has been limited by resources and available personnel. We have increased our efforts recently with respect to flannelmouth sucker and will do so on other species as soon as feasible. The GCMRC fisheries cooperators have held discussions regarding synthesis of available information and increased efficiency of monitoring efforts in relation to management goals.

Ad hoc Response: The Ad hoc shares the PEP's concern for studies of other native fish and we support efforts to track these species' status and trends. Approaches being used for humpback chub should also have application with at least flannelmouth sucker and bluehead sucker.

Extend Exotic Fish Monitoring to Non-salmonid Species

PEP Recommendation: For the CRE below Lee's Ferry, the management goals for non-native fish are related to their impacts on native species. The PEP was impressed by the efforts to develop a program to estimate the abundance of salmonids in the Colorado River, but felt some effort should be (re-)allocated to the other components of risk to native species, especially with respect to predation. There is no explicit program for warm-water exotic fish species. The PEP suggests that the species should be ranked for their potential for impacting native species, and that monitoring metrics be developed for the important species that address potential risk to native fish. Thorough analysis of available data should assist in the evaluating the feasibility of monitoring programs for these species.

GCMRC General Response: GCMRC shares these concerns and will address these issues as resources permit. We have begun a more focussed monitoring effort to delineate the distribution on non-native species. Similarly we have targeted programs planned for FY02 and FY03 to gather more reliable data regarding predation on native fish by non-natives in the LCR and mainstem CR near the LCR.

Ad hoc Response: The Ad hoc agrees with the PEP recommendation to expand the fish monitoring to warmwater non-native fish species. We believe, however, that a preliminary

analysis by GCMRC to prioritize species and habitats should be accomplished because the budget for this program has limits. This analysis should give consideration to the degree of negative interactions between native and non-native fish species. Given these considerations, we advocate that this expansion of emphasis be given serious consideration in the sequencing of information needs by the TWG and in the resulting recommendations sent to the AMWG.

Management Issues

PEP Recommendation: The PEP observed considerable variation in the analytical effort expended, the timeliness of reporting, and the availability of standardized databases among programs for aquatic resources. A standardized annual reporting cycle is a key component of any monitoring program. The PEP recommends that the contracting process needs to be much more tightly controlled, and wonders whether greater 'in-house' capability is required at GCMRC to achieve long-term consistency and quality in the monitoring program.

GCMRC General Response: GCMRC concurs with both this concern and the recommendation. We have begun development of a standardized database and reporting procedure/requirement. We will develop consistent reporting requirements for external awards in the biology program. This has already been done with regard to the fisheries monitoring effort and GCMRC is developing (as stated above) an explicit feedback process for monitoring results to AMWG.

Ad hoc Response: The Ad hoc concurs with the PEP and GCMRC that standardized and timely reporting, along with standardized data entry and database formats, will benefit the program. It also makes sense to us that longer term contracts will lend a greater consistency to information collection and help to assure meaningful results. These longer term contracts can be made conditional on satisfactory performance, and we urge GCMRC to maintain a quality assurance element in their programs to ensure this performance is achieved.

[1] Anders, P., M. Bradford (Chair), P. Higgins, K.H. Nislow, C. Rabeni, and C. Tate. 2001. Draft report of the Aquatic Protocol Evaluation Program Panel. Report to Grand Canyon Monitoring and Research Center, Flagstaff, Arizona. November 28, 2001.