

DRAFT MEMO

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TO: Adaptive Management Work Group
Technical Work Group

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SUBJ: Development and Implementation of a Long-term
Monitoring Plan for Fish in the Colorado River Ecosystem

INTRODUCTION

The Grand Canyon Monitoring and Research Center (GCMRC) is responsible for developing and implementing long-term monitoring that detects and assesses change in resources, in response to dam operations under the Record of Decision (ROD). The status and trends of native and non-native fish populations in the Colorado River ecosystem is one of the resources monitored in the river corridor. Elements associated with monitoring development and implementation include assessing previous efforts, determining appropriate temporal and spatial scale requirements, and testing alternative methodologies that effectively provide the needed monitoring data.

The interim period between development and implementation requires a strategy that collects data pertinent to resources and provides opportunities to test monitoring protocols. GCMRC's strategy for developing a long-term monitoring plan was based on the advice of the Transition Work Group and is consistent with the protocols described in the FY 1997 – 2002 Strategic Plan. This strategy called for GCMRC to:

1. Maintain a transition monitoring program;
2. Conduct synthesis activities;
 - review the information in the Data Integration Report (SWCA) and the GCES Phase II Biology Integration Report (Patten),

- commission synthesis efforts as part of the FY 1998 – 99 transition monitoring program (Gorman – FWS),
 - analyze native fish data in conjunction with development of the conceptual model (Walters et. al),
3. Continue to collect interim baseline data;
 4. Develop a conceptual model of the Colorado River ecosystem;
 5. Consolidate existing fish data into a single database managed by GCMRC and analyze the data base as appropriate;
 6. Develop a draft long-term fish monitoring plan based on the activities outlined above;
 7. Conduct a PEP of current and past monitoring activities as well as the draft long-term fish monitoring plan;
 8. Revise the draft long-term fish monitoring plan to address PEP findings and recommendations;
 9. Implement the final long-term monitoring plan through the RFP process;
 10. Review the long-term fish monitoring program after 5 years.

The progress made with regard to conceptual modeling and data assessment, the delay in other areas and the impending management actions that involve fish (TCD, steady flows) has caused the GCMRC to re-evaluate the steps outlined above. The conceptual modeling effort in particular has resulted in several comments and corresponding recommendations that logically should precede long-term monitoring implementation. Included in these comments are the lack of carefully analyzed historic fish data, the inability of the existing sampling programs to detect population changes beyond recruitment failure, and a focus that needs to change from a primary native fish concern to a fish community analysis (Walters and Korman 1999). These comments/concerns were reiterated by regional researchers and stakeholders at the Temperature Control Workshop (November 1999). Lastly, conflicts over intellectual property associated with monitoring design, historic data and providing scientific input have hampered efforts in the areas of historic data assessment and cooperative efforts to help GCMRC develop a long-term monitoring plan.

Both Walters and Korman (1999) and researchers familiar with fish data collection efforts in the Colorado River have discussed the shortcomings of previous and current field efforts to assess the effects of ROD dam operations on fishes below Lees Ferry. Fishery work in Grand Canyon has sought fish rather than sample in a manner that characterizes trends in relative abundance and distribution: river-scale abundance trends are not available because sampling efforts represent only local fish abundance data. Sampling has been biased for young fish and adults, but intermediate juvenile size fish status is unknown because gear-types do not capture this size class adequately. Lastly, sampling stations and methods have not been consistent through time (at one time data collection involved up to 5 entities). Clearly to continue in a status quo effort (award another short-term monitoring contract) would be a poor decision and would further delay progress in fish monitoring efforts.

Approaches to the problem as GCMRC views it are three.

1. Expending greater effort in data analysis and suspending data collection efforts until we are confident in methodology and purpose of data collection. This option does not provide opportunities to meet compliance needs for native fish.
2. Pursue both avenues that include maintaining historic levels of data collection and intensive data analysis, testing, and plan design. This approach is not pragmatic. The budget for this solution would require diminishing efforts in other biological resource areas to meet a budget estimated at \$600,000 or more. Secondly, as has been pointed out above, previous data collection efforts have not resulted in comprehensive analyses and cannot provide any greater confidence that these efforts yield any more information than current mainstem efforts. Lastly, a parallel effort may exclude some researchers from participating in the analysis component, as they would be committed to a data collection effort.
3. Emphasize data analysis and monitoring design, conduct data collection efforts that characterize critical life history stages (e.g., spawning, recruitment, condition and relative abundance) and meet compliance needs, but also use these trips to test alternative sampling methods.

The GCMRC discussed these approaches with the Technical Work Group in December. The TWG's recommendation was to further develop the proposal and explore

approaches 2 and 3, it was generally agreed that the status quo, and approach 1 are not feasible (see TWG minutes, Dec 8 1999). Taking the comments from the TWG, and researchers into account, we are proposing a hybrid approach that blends elements of solution 2 and 3. The strategy provides development/testing/refinement of a long-term monitoring plan, maintains basic monitoring of fish below Lees Ferry, and provides an opportunity for individuals to participate in the development of a long-term monitoring plan.

This strategy includes scaling back the mainstem fish monitoring planned for FY 2000, and to reprogram existing funds to support the collation, synthesis, and analysis of existing fish data, and to develop and test a long-term fish monitoring protocol. This plan, schedule and budget for implementation is outlined and described below.

GCMRC's Plan for Colorado River Long-term Fish Monitoring

Development and Implementation

Overview

The GCMRC has multiple goals associated with its plan for long-term fish monitoring in the Colorado River ecosystem. These goals include 1. The development, testing and refinement of long-term monitoring protocols; 2. Monitoring that runs in parallel with plan development and characterizes fish recruitment, survival and abundance; 3. A structure that provides an opportunity to participate and not preclude competing for monitoring projects in the future. This plan involves the participation of three principle groups, each with specific roles and a work schedule that include convening participants in a workshop format, electronic communication and field work. The field work component coincides with proposed monitoring effort and field testing of protocols, while the workshops will focus on monitoring protocol development and data analysis. Collectively, the groups form the Fish Long-term Monitoring Workgroup (FLMW). The following provides information concerning the 1) Goals and objectives, 2) Workgroup elements, 3) structure, 4) implementation schedule and 5) budget for this workgroup.

1. Goals and Objectives of Workgroup

The goal of the workgroup is defined as the following.

To develop a long-term plan for monitoring of fish in the Colorado River below Glen Canyon Dam that is integrated with Lees Ferry Trout monitoring and maintain monitoring efforts that provide data sufficient to determine fish recruitment, condition/health and survivorship, and abundance.

The group will use the elements outlined below to achieve this goal.

The monitoring objective that will define protocol development is the following.

To know the status and trends of fish communities relative to the Record of Decision, excluding discrete experimental actions (i.e., those actions that have specific time frames that may require additional data collection specific to resource responses and to questions being asked about a life history parameter, like temperature and mainstem recruitment).

Secondarily, the workgroup will be asked to identify additional research hypotheses that would augment the long-term fish monitoring plan to assess the effects of Beach/Habitat-Building Flows, Habitat Maintenance Flows, Endangered Fish Research Flows, and Temperature Control Device operations

2. Protocol Development and Monitoring Elements

Protocol development includes five elements associated with monitoring. Interim monitoring includes three elements that feedback to protocol development. The five elements of development are described below:

1. Sampling Design
Randomized, intensive, periodic, block determined by analysis of historic data and consideration of monitoring objectives.
2. Collection plan
Where, when, how often determined by sampling design
3. Database structure
Determination of linked fields, types of data needed, data sheet/entry framework, determined by previous two steps
4. Analysis and report structure
Determination of how data are analyzed and how data are communicated.

5. Field testing of plan
Field and office based testing to determine what works and what needs refinement.

The three elements of interim monitoring include:

6. Interim monitoring effort
Data collection and data entry that provides abundance, spawning, recruitment and survival and feedback into first five elements. Feedback to sampling design, database structure, collection plan through field and office data entry efforts. This interim monitoring effort is adjusted in response to continued development of 5 elements identified above.
7. Analysis and report structure
Determination of how data are analyzed and how data are communicated. Feedback to development via review of submitted reports.
8. Field testing of plan
Field and office based testing to determine what works and what needs refinement. Feedback to development by data entry problems, analysis, reports.

The plan we have constructed requires that monitoring run in parallel to provide opportunities to test alternative methodologies and to test the likelihood that monitoring protocols can be standardized.

3. Protocol Development and Monitoring Group Structure

Implementing a program of protocol development and concurrent monitoring will be done by initiating a Fish Long-term Monitoring Workgroup (FLMW). The workgroup will be composed of three subgroups (core, staff and field), each with specific roles and responsibilities associated with the elements identified with long-term monitoring. The roles are described below.

3 Groups: Core Group, Staff, Field/monitoring support

- I. Core Group is composed of
 - 5-6 people of local expertise (e.g., Douglas, Persons, Valdez, Gorman)
 - 2-3 Stock assessment analytical people
 - 1-2 statistical people
 - 1-2 people that are conducting monitoring in other river systems

1 facilitator familiar with fish
Role is to complete 5 elements of monitoring objectives

II Staff/assistants

GCMRC staff (Flaccus, Yard, Meitz, Ralston)
Bureau of Reclamation (Kubly, Crist?)

Role is to lead, assist and participate with core group and monitoring group in completing elements of monitoring objectives

III. Field crew/monitoring group

6-8 people with field expertise

Role is to collect ongoing monitoring data and help with field testing of proposed monitoring protocols including analysis and report writing.

The workgroup will be formed by GCMRC issuing a Commerce Business Daily (CBD) announcement requesting researchers interested in participating in the Fish Long-term Monitoring Workgroup (FLMW). Contracts will be initiated with scientists to work with GCMRC as part of the FLMW. Members of the FLMW will be selected based on their experience working with native and non-native fish in the Colorado River ecosystem. Criteria for selection include their knowledge of existing fish databases, their expertise in quantitative analysis of fisheries data, the development of monitoring plans in an adaptive management context, or field expertise.

4. Implementation of Protocol Development Workgroup

The schedule for implementing this strategy is illustrated in Table 1. The plan is divided into a two-year or two-phase sequence. Phase I includes a development and monitoring phase and Phase II involves implementation and testing. As stated above, this plan involves the participation of three principle groups, each with specific roles and a work schedule that include convening participants in a workshop format, electronic communication and field work. The field work component coincides with proposed interim monitoring effort and field testing of protocols, while the workshops will focus on monitoring protocol development. For ease of communication, this plan describes the schedule associated with monitoring protocol development (Phase I) followed by the Implementation and testing component (Phase II).

Phase 1. Monitoring Protocol Development & Interim Monitoring

A. Monitoring protocol development.

As previously stated, the development of a monitoring plan requires consideration of the monitoring objective and the elements that constitute protocol development. The schedule GCMRC has developed involves a step-wise approach that proceeds from database development to sampling design to data collection and reporting. The mechanism for this process involves three workshops that clarify the objectives for each element and sets-up deliverable schedules associated with each. For example, the initial workshop is intended to begin addressing database development. Consolidation, sharing and analysis of historic data are essential to know what information historic data and sampling methods yield with respect to status and trends. Participants will be assigned tasks that compliment their expertise. Objectives for each element have been stated previously, but are developed in more detail below.

I. Database development objectives.

1. Convene workshop in late January/February
2. Determine data sharing protocols.
3. Determine extent and format and structure of historic data.
4. Determine information that historic data hold regarding baseline status and trends.
5. Determine areas of variability in historic data (e.g., what are the levels of effort (CPUE, net sets, location, seasonality).
6. Determine linked fields and database design.
7. Determine types of data needed
8. Develop data sheet/entry protocols and methods.
9. Provide preliminary results prior to sample design workshop.

II. Sampling design objectives.

1. Convene workshop in May.
2. Determine analysis that will be used for status and trends.

3. Determine parameters that measure monitoring objectives.
4. Determine level of effort (e.g., spatial & temporal) that provide meaningful data.
5. Provide report prior to data collection plan workshop.

III. Data collection plan objectives.

1. Convene data collection plan workshop in July.
2. Develop data sheets/software for field collection
3. Define data standards previously achieved under database development.
4. Determine schedule of methodology testing
5. Determine format for reporting data analysis.
6. Provide standardized protocols for long-term monitoring.
7. Have draft plan completed by November for testing in January-Sept 2001.

B. Interim Monitoring Program

An interim monitoring effort will be implemented. The objectives of the monitoring will be to characterize spawning, recruitment, survivorship, condition/health and relative abundance of fish below Lees Ferry. Historic monitoring efforts have consisted of three mainstem trips per year and a long-term effort (40 days) at the mouth of the Little Colorado River in the spring. Funding constraints prohibit continuing the historic data collection efforts and developing long-term monitoring protocols simultaneously. We have considered the objectives for this next year and evaluated the purpose of each trip and are proposing the following trips and associated objectives.

1. **Overwintering survival of YOY.** The trip objective is to determine the relative abundance of previous years' cohort in the mainstem prior to spring spawning efforts. Netting and electrofishing. Scheduled to occur in January/February.
2. **Native fish spawning and recruitment in LCR.** To determine number of adult fish spawning in LCR in spring and level of recruitment success (cohort number). Mark recapture effort and yoy productivity. Scheduled as three 10-12 day trips in April, May/June and late July in the LCR.
3. **Relative abundance and productivity in mainstem.** To characterize relative abundance and productivity of fish in the mainstem of the Colorado River and tributaries following the year class recruitment, and prior to winter/spring

spawning efforts. Netting and electrofishing. Scheduled as a 17-18-day trip to occur in September.

The duration of these trips is dependent on the level of effort required to provide the necessary data. We have tentative trip lengths that follow historic patterns, but the analysis of historic data will also be used to determine trip length (i.e., power analysis for the level of effort at the LCR may not merit historic trip lengths). We are developing specific protocols and levels of effort for these monitoring trips that represent combined levels from previous collecting efforts by BIO/West, AGFD, USFWS, and ASU. These preliminary protocols will be used to obtain the necessary permits (NPS, AGFD, FWS, Navajo, Hualapai). As with the protocol development, we will use the CBD process to hire field crews that will also conduct data entry, analysis and write interim monitoring reports. We will submit a monitoring plan, subject to revision based on analysis, to these entities for the permits by mid-January. This is the minimum amount of time needed to complete permitting and allow work to take place in April 2000.

Phase II. Implementing and Testing of Draft Monitoring Plan.

Following the drafting of a long-term monitoring plan the following year will be used to implement the protocols and to test proposed methodologies. The rationale behind this is to identify weak spots in the plan, to refine the protocols and provide opportunities to identify areas of monitoring that need further research. While Phase 1 had parallel components of development and monitoring, Phase II will have a single component of monitoring that will be used to test the draft plan. The final monitoring plan will consist of defined level of effort and trip schedule. The RFP for long-term monitoring would be released in July or August of 2001 for five-year implementation in FY2002 (January 2002).

Protocol Evaluation Process

The protocol evaluation process will follow a schedule similar to that completed by the physical science program. Following the development of the draft monitoring plan, a panel of peer review scientists will be assembled to review the process and recommended protocols. This first PEP panel will meet in October. They will be

included in the September monitoring effort if they are available. Convening the panel in October provides time for their recommendation to be incorporated in the draft monitoring plan prior to implementation in winter and spring of 2001. The panel will be reconvened the following spring/summer to discuss the findings of the test monitoring protocols and prior to release of the RFP for long-term monitoring.

Literature Cited

Walters, C. and J Korman 1999. Ecosystem modeling for evaluation of adaptive management policies in the Grand Canyon. Conservation ecology, in press.

5. Budget Estimates

a. Interim monitoring

Personnel

Field crew

2 trip leaders @ 15.00/hr+ 50-100% overhead X 70 days X 10hr/day

\$31,500.00- 42,000

4-6 field techs @ 12.00/hr + 50-100% overhead X 70 days X 10 hrs/day

\$75,600 – 100,800

Office

Data entry 2 techs @ 10.00/hr +50-100% overhead X 60 days X 8 hrs/day

\$14,400 - 19,200

Analysis & report writing 2 trip leaders @ 15.00/hr +50-100% overhead X
40 days X 8 hrs/day = **14,400 – 19,200**

Total Personnel costs = **\$148,000 – 181,200**

b. Protocol development

Core Group Costs

Workshop Costs

Travel & per diem/participant 700.00/person X 12 people

8,400

Pay per participant 30.00/hr X 8 hrs X 3 days + 50-100% overhead

1,080.00 - 1,440/person X 12 people **13,000-17,280/workshop**

Estimated cost for 3 workshops **\$65,000 – 77,040**

Analysis & report writing costs

Pay per participant 30.00/hr X 8 hrs X 30 days + 50-100% overhead

10,800 – 14,400/person X 12 people **\$129,600 – \$172,800**

Total Estimated Workgroup Personnel Costs **\$342,600 – 431,040**

c. Equipment

Capital costs anticipated for field effort

GPS Pluggers/data logger	18,000
PIT tags & Scanners	18,000
Nets	20,000
Misc. equipment	5,000

Total estimated cost **\$404,100 – 492,940**

Costs for this plan can be covered under existing fish monitoring funds and in-house research funds. In-house research is a appropriate fund to use for this work as it will involve GCMRC researchers synthesizing historic data and increasing knowledge of resource linkages.