GCDAMP Protocol Evaluation Panel Prospectus: Fisheries Program Review

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The Glen Canyon Dam Adaptive Management Program (GCDAMP) advises the U.S. Secretary of Interior (Secretary) on the effects of Glen Canyon Dam operations and related management actions on key resources found in the Colorado River and its tributaries in Glen, Marble, and Grand Canyons, Arizona, between the Glen Canyon Dam forebay and Lake Mead. The GCDAMP fisheries monitoring and research program is a collaborative effort of the U.S. Geological Survey Grand Canyon Monitoring and Research Center (GCMRC) and several cooperators including contractors, the U.S. National Park Service, the U.S. Fish and Wildlife Service, and the Arizona Game and Fish Department. Key fishery resources include native humpback chub *Gila cypha*, an endangered species, and nonnative rainbow trout *Oncorhynchus mykiss*, a popular sport fish. Maintenance of two self-sustaining and stable populations of humpback chub in this portion of the Colorado River is seen as a key resource goal, as is the maintenance of an economically-viable rainbow trout sport fishery in the tailwater of Glen Canyon Dam. Maintaining and improving the state of other native fish species, including razorback sucker *Xyrauchen texanus* is also a goal. Lastly, managing non-native fish species that pose a risk to native fish and/or rainbow trout is also an important concern. As lead science provider for the GCDAMP, GCMRC periodically convenes review panels to assess the quality, rigor, and need for various research and monitoring programs. This is a draft prospectus for review of the GCDAMP fisheries monitoring and research programs scheduled for summer 2016.

## Fisheries Program – Background and Key Questions

The fisheries monitoring and research program aids the GCDAMP decision making processes by: 1) estimating the current state of key resources, and 2) quantifying the relative impacts of various factors (including management actions) on the vital rates (survival, growth, and movement) of various fish species to improve predictions of the impacts of future management decisions on the state of key resources. Given the complexity and scale of the highly managed Colorado River and its tributaries, long-term monitoring is crucial for detecting and evaluating the magnitude of changes in resource conditions in response to environmental variability and management actions. Research activities typically focus on shorter-term specialized sampling, interpretation of data using models, and laboratory-based experiments to reduce uncertainties. Monitoring projects typically collect catch-per-effort and/or mark-recapture type data using the best possible protocols. Monitoring protocols have evolved through time. For example, mark-recapture studies in the Little Colorado River (LCR), a tributary of the Colorado River in which many humpback chub spawn, began in 2000 and eventually replaced catch-per-effort monitoring. In another example, mark-recapture in a fixed section of the Colorado River near the LCR confluence began in 2009 as a research activity, and the success and insights from this project led to its continuation as a monitoring program.

The fisheries program is currently grappling with how to plan future monitoring and research activities in light of recent advances in our scientific understanding, proposed management actions, and financial constraints. Important questions include:

* **What research and monitoring activities should be prioritized with respect to rainbow trout in Glen and Marble Canyon?**

Many of the current fishery monitoring and research projects focus on rainbow trout in the upper 75 miles of Colorado River between Glen Canyon Dam and the Little Colorado River confluence. Rainbow trout are desired between the dam and Lees Ferry, but are known to prey on juvenile humpback chub near the LCR confluence, where juvenile humpback chub survival is negatively correlated with rainbow trout abundances. Modeling of long-term catch-per-effort data, combined with detailed study of rainbow trout early life history in the tailwater, has established that rainbow trout recruitment in the tailwater is linked to dam operations. More recently, a costly, large-scale mark-recapture has established that the majority of rainbow trout recruitment near the LCR confluence comes from upstream sources. In order to lessen downstream dispersal of rainbow trout and potentially stabilize the tailwater trout fishery, managers are proposing dam operations designed to produce flows that limit rainbow trout recruitment in years when flow conditions otherwise would be expected to produce large recruitment events. Determining the effectiveness of these “trout suppression” flows, and continuing to provide the best estimates of the current state of the rainbow trout fishery and the drivers of changes in fishery condition are key long-term concerns of stakeholders.

* **What research and monitoring activities should be prioritized with respect to humpback chub, both around the LCR confluence, where most individuals are found, and at other locations that could potentially harbor secondary populations?**

Mark-recapture studies in the LCR and at a fixed site in the Colorado River near to the LCR confluence have provided important insights into vital rates and abundances of different size classes of humpback chub. However, opportunities and needs still exist for refining monitoring and research. Our understanding of humpback chub vital rates and size-class abundances is much more limited at other locations, although catch rates in reaches farther downstream in Grand Canyon appear to be increasing in recent years. Based on the success of monitoring at the fixed site in the Colorado River near the LCR confluence, scientists and stakeholders alike are interested in establishing one or more additional fixed sites downstream to determine how drivers of vital rates may differ as well as to develop more accurate abundance estimates. Extending mark-recapture sampling at one or more sites would likely require a reallocation of effort currently placed in Glen and Marble Canyon to study rainbow trout.

* **What research and monitoring activities should be prioritized to track statuses and trends of native and nonnative fish species outside of fixed study locations?**System-wide monitoring of native and nonnative fish populations is currently accomplished through two trips primarily using electrofishing at sites selected through a randomized sampling design, and a single trip using hoopnets and primarily focused on humpback chub aggregations in the Colorado River. Of particular interest are detection of, and information on, potentially harmful/invasive nonnative species and rare native species such as the endangered razorback sucker. Determining if, and how, these programs can be improved through use of additional gear types and sampling methods (e.g., angling, e-DNA, etc.), targeted research (e.g., use of otoliths to determine natal origins of different species), or implementation of approaches to improve accuracy and efficiency (e.g., field-based data entry into computers, use of tender boats, etc.) is an important concern for continuing to provide the best possible information concerning the status and trend of fish species throughout the river.
* **What research or monitoring is required to judge the effectiveness of ongoing experimental management involving translocation of humpback chub and removal of trout from Bright Angel Creek and potentially other locations?**Are available data sufficient to judge the effectiveness of these experimental management actions, and if so what data or analyses should be prioritized to inform managers.

## The Protocol Evaluation Panel (PEP)

The PEP will be developed and managed by GCMRC with support from the GCDAMP Science Advisors Program (SAP) Executive Coordinator. The review panel will consist of individuals with widely recognized expertise in current best practices for designing, implementing, and analyzing the data from high-quality fisheries monitoring and research programs. The GCMRC will reimburse the panel members for their travel expenses, and provide an honorarium to panelists who are not U.S. federal government employees. While the above questions should provide some guidance to the review panel, it is desired that the panel consider all aspects of the GCDAMP fisheries monitoring and research program described in the current three-year (FY 2015-2017) GCDAMP Triennial Work Plan (Projects 6 – 9). The review panel will be asked to review the program and make recommendations regarding its scope and direction as well as provide an evaluation and recommendations for future work with respect to the level of effort, study design, and relevance of individual research activities to existing and emerging monitoring and research questions.

The review panel will:

1. Review background documents on the GCDAMP fisheries monitoring and research program prior to participating in a review workshop at the GCMRC in Flagstaff, AZ.
2. Spend time on the river to experience the physical setting of the investigations and its constraints, and participate in open workshop sessions to hear and discuss presentations on the fisheries investigations by the GCMRC and cooperators.
3. Meet in a closed workshop session following the river visit and open sessions to discuss potential questions, comments, and recommendations to the GCDAMP, and discuss assignments and the timeline for completing a draft report on its findings and recommendations.
4. Prepare a draft report for review and feedback from the GCMRC and the SAP Executive Coordinator.
5. Prepare a final report incorporating the feedback from the GCMRC and the SAP Executive Coordinator. The GCMRC in turn will deliver the final report to the GCDAMP Secretary of the Interior’s Designee (Secretary), Adaptive Management Work Group (AMWG), and Technical Work Group (TWG) for their guidance.