A PROPOSAL TO INVESTIGATE THE FEASIBILITY OF DEVELOPING A PROGRAM TO AUGMENT THE POPULATION OF HUMPBACK CHUB (*Gila cypha*) IN GRAND CANYON

By

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OBJECTIVE

At the request of Dr. Steven Gloss from the Grand Canyon Monitoring and Research Center (GCMRC), the U.S. Fish and Wildlife Service (USFWS) has developed this proposal to: 1) examine the feasibility of establishing a supplemental stocking program for humpback chub (*Gila cypha*) in Grand Canyon using wild caught young of year (YOY) humpback chub removed from the Little Colorado River (LCR) and grown out to a large size in captivity 2) examine the feasibility of developing a captive broodstock to be used for a captive breeding program for humpback chub, and 3) examine the feasibility of establishing a second spawning (or expand the current) population of humpback chub in Grand Canyon. The request from GCMRC stemmed from a request by the Adaptive Management Work Group for Glen Canyon Studies to perform a feasibility study for establishing a captive broodstock program. Establishment of a captive broodstock for humpback chub and supplemental stocking has been proposed as a potential conservation action (USFWS 1990), as has establishing a second population of humpback chub (USFWS 1990, USFWS 1994, USBR 1995). Supplemental stocking using wild caught fish grown out in captivity is currently being used as a successful management action to conserve the razorback sucker population in Lake Mohave and is worthy of consideration in this feasibility proposal.

We stress that we only propose to investigate the feasibility of carrying out the above management actions - this document does not constitute a proposal to implement these actions. Any initiation of management actions will require thorough review both within the Service and among the appropriate cooperating agencies as well as requiring additional funding to the agencies carrying out the actions. However, as a cooperating agency with GCMRC, we have agreed to perform this feasibility study. These efforts will be coordinated with the Upper Colorado River Endangered Fish Recovery Program in an effort to better unify recovery efforts throughout the Colorado River Basin. The ultimate performance of any of the actions identified herein, and by whom, is not an element of this proposal.

FEASIBILITY OF ESTABLISHING A SUPPLEMENTAL STOCKING PROGRAM USING WILD CAUGHT YOUNG OF YEAR FISH

Specifically, we propose to investigate the feasibility of capturing wild YOY humpback chub from the LCR, transporting them to a grow out facility until they reach a larger size, marking them with a unique identifier (such as a PIT tag), and releasing them back into Grand Canyon.

By growing wild humpback chub to a larger size class before release, they could reasonably be expected to have an increased probability of survivorship. Larger humpback chub should be less prone to the effects of predation by nonnative

fishes (Valdez and Ryel 1995), and to the detrimental effects associated with cold, fluctuating river flows (Clarkson and Childs 2000). If fish were tagged prior to release, ongoing monitoring activities should be able to detect the success or failure of this type of effort within a relatively short period of time (i.e. within two or three years).

Through the feasibility study we will address the following questions:

1. Where could the supplemental fish be grown? We will identify the characteristics that a facility should posses in order to successfully raise humpback chub until they reach the desired length. Based on recommended sizes and numbers of fish to be stocked as well as other information that will be produced as a result of this feasibility study, we will estimate time and resource commitments that would be necessary to grow out the desired numbers/sizes of fish. We will identify space requirements, water quantity/quality/temperature requirements, and other facility considerations (e.g., quarantine requirements, isolation from other species). A decision matrix would be developed that lists pertinent information for the characteristics necessary to successfully raise YOY chubs.

2. What size fish should be collected, how, from where, and when? We will assess the availability of different sizes of fish as well as the time and cost to grow out each to an acceptable size (i.e. should we remove 25 mm fish, 50 mm fish, 75 mm fish, etc.). Other factors that will need to be considered are the optimal timing for removal. Optimal timing for removal (i.e. maximum yield and chance for survival vs. minimum logistics) will be considered. Considerations will be given to achieve an optimal success for collection of YOY fish in LCR, with minimal impact on the wild population. Other factors that may be considered are timing of flood events in LCR, and the ability to logistically carry out the mission during different times of year.

   We will develop a detailed methods section that will include the optimal method(s) for collecting these fish, as well as the best place(s) to collect these fish. One important consideration will be maintaining the maximum likelihood for retention of genetic integrity (i.e. a number of fish collected from various locales in LCR will likely be better than collecting all fish from one locality). Other considerations will include the logistics of obtaining fish from a variety of locations, the best methods (gear types) for collecting a desired length of fish, and the logistics of keeping fish alive from the time of collection to arrival at the hatchery.

3. What is the best size to grow out captive fish before release? For example, 150 mm fish can be PIT tagged, and tracked once released back into the wild. Growing fish out to this size would facilitate the ability to

distinguish wild produced fish from captive fish. However, it may be advantageous to grow the fish to larger than 150 mm (e.g. 200 mm). We will investigate the estimated survivorship rates of different sizes of fish and reach a conclusion that balances the trade offs between the best probabilities for survivorship against considerations for the amount of time needed for fish to reach a desired length (e.g. 200 mm fish will have a higher probability for survivorship, but may take too long to grow, or take too much space to grow). Answering this question may also dictate what types of hatchery facilities would be optimal for growing these fish. Ultimately this information will be used to determine the most cost effective size of fish to stock with our measure of success being recruitment into the adult population (e.g., larger fish will cost more to raise, but if they recruit into the adult population at a high enough rate to offset those additional costs, then they would be deemed more cost effective than raising larger numbers of smaller fish).

4. How many fish will need to be released into the wild in order sufficiently supplement the population of humpback chub in Grand Canyon? This question will be answered by investigation of the existing models for humpback chub. Dr. C. Walters and L. Coggins at GCMRC are currently performing such modeling. These models should be able to provide a rough estimate of the number of fish needed to augment the population of humpback chub in Grand Canyon. The models include calculations of survivorship at various lengths, and potential effects of enhanced recruitment to the adult population. Our ability to adequately address this question will be dependent on the models available.

5. Where and when will fish be released back into the wild? We will evaluate if fish should be released into the LCR, into the mainstem Colorado River, or into another tributary in Grand Canyon (discussed below). Their ability to acclimate to each environment will be evaluated. Additionally, logistical considerations will be considered such as the ability to land a helicopter within Park boundaries as well as other considerations for the welfare of the fish (e.g. chances of re-infestation of parasites, chances of survivorship against predators, chance of affecting wild produced fish in the LCR, etc.).

   We will evaluate the optimal time for release of the fish back into the wild. Such considerations may include expected impacts of flood events in the LCR upon survivorship, and expected impacts of mainstem flow regimes on survivorship (e.g. would it be better to release the fish into LCR under high mainstem flows when the LCR is ponded, into the mainstem under a steady flow regime, etc.).

FEASIBILITY OF ESTABLISHING A SUPPLEMENTAL STOCKING PROGRAM USING HATCHERY PRODUCED FISH FROM A CAPTIVE BROODSTOCK

Specifically, we propose to investigate the feasibility of establishing a captive broodstock of adult humpback chub and using fish produced from this broodstock to supplement Grand Canyon populations of humpback chub. We propose investigating the feasibility of removing a number of YOY fish from LCR to contribute to the development of an adult broodstock program.

Specific questions (or tasks) we will address in performing this feasibility study will include:

1. Is a captive adult broodstock needed at this point in time, and what will it contribute? We will address this question by meeting with experts in the field of broodstock development, and in the fields of genetics, ecology and stock assessment. There are many known pitfalls that can occur from the development of a broodstock, including genetic issues, policy on captive broodstock issues, inability to have fish imprint, lack of natural selection and its resulting effects upon the wild population, chances of introducing foreign parasites, etc. These considerations will be listed and discussed, and a literature background will be provided. We will also assess the need(s) for a captive broodstock at this point in time, and weigh out the pros and cons of supplemental stocking using fish produced from broodstock vs. YOY fish collected from the LCR and grown out at a hatchery.

2. Identification of components necessary to develop a broodstock management plan. Given the time and funding constraints associated with this project, it is beyond the scope of this project to develop a broodstock management plan. We will however address the feasibility of developing a broodstock management plan (e.g., genetic considerations to be addressed, how to determine the number of fish needed, hatchery requirements) along with the costs associated with developing the broodstock management plan.

3. Where to hold broodstock, where to raise fish, what size to raise fish, how many, where/when to release? These questions have been addressed in questions 1-5 of the previous section.

FEASIBILITY OF ESTABLISHING A SECOND POPULATION IN TRIBUTARIES OF GRAND CANYON OR EXPANDING THE LITTLE COLORADO RIVER POPULATION

The biological factors necessary to establish a second population in Grand Canyon have previously been addressed (Valdez et al. 2000). Although tributaries were not deemed optimal for establishment of a second population of humpback chub (Valdez et al. 2000), we believe that further investigation could be of value. Specifically, we would like to explore the feasibility for transplanting fish above Chute Falls (i.e. above 14.9 km) in the LCR, and for establishing a second population in Havasu Creek. We wish to take the next logical step, and explore the concerns that would be associated with performing such management actions. Primarily this would entail meeting with the appropriate Tribal and Park personnel and discussing their concerns and issues.

LITERATURE CITED

Clarkson, R.W. and M.R. Childs. 2000. Temperature effects of hypolimnial release dams on early life stages of Colorado River Basin big river fishes. Copeia 2000: 402-412.

Coggins, L., M. Yard & C. Paukert. 2002. Piscivory by non-native salmonids in the Colorado River and an evaluation of the efficacy of mechanical removal of non-native salmonids. Grand Canyon Monitoring and Research Center, U.S. Geologic Survey, Flagstaff, AZ. 40 pp.

Valdez, R.A., S.W. Carothers, M.E. Douglas, M. Douglas, R.J. Ryel, K.Bestgen, D.L. Wagner. 2000. Final research and implementation plan for establishing a second population of humpback chub in Grand Canyon. Grand Canyon Monitoring and Research Center, U.S. Department of the Interior, Flagstaff. 56 pp.

Valdez, R.A. & R.J. Ryel. 1995. Life history and ecology of the humpback chub (*Gila cypha*) in the Colorado River, Grand Canyon, Arizona. Final Report to Bureau of Reclamation, Salt Lake City, Utah. Contract No. 0-CS-40-09110. BIO/WEST Repot No. TR-250-08. 286 pp.

USBR. 1995. Operation of Glen Canyon Dam: Final Environmental Impact Statement. U.S. Bureau of Reclamation. 337 pp. plus attachments.

USFWS. 1994. Final Biological Opinion: Operation of Glen Canyon Dam as the modified low fluctuating flow alternative f the final environmental impact statement. Ecological Services Arizona State Office, Phoenix. 56 pp.

USFWS. 1990. Humpback chub Recovery Plan. U.S. Fish and Wildlife Service, Denver, 43 pp.

COMPLETION SCHEDULE AND BUDGET

Schedule:

Feb-Apr 2002	Produce Draft Feasibility Study
25 April 2002	Submit Draft Feasibility Study to GCMRC
June 2002	Submit Final Feasibility Study to GCMRC (submittal date is subject to review time - final will be submitted w/n 1 month of receiving reviewer comments)

Budget:

Salary	
Van Haverbeke, Fishery Biologist (5 payperiods @ $2200 ea.)	$11,000
Sponholtz, Fishery Biologist (3 payperiods @ $2425 ea.)	$7,275
Keeler-Foster, Geneticist (1 payperiod @ $2425 ea.)	$2,425
Other	
Travel	$1,000
Misc (photocopying, office supplies, etc.)	$500
Total	**$22,200**