

**A REVIEW OF THE “GRAND CANYON
NON-NATIVE FISH CONTROL PLAN I:
SHORT TERM MONITORING AND RESEARCH ACTIONS”**

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JANUARY 2009

EXECUTIVE SUMMARY

A REVIEW OF THE “GRAND CANYON NON-NATIVE FISH CONTROL PLAN I: SHORT TERM MONITORING AND RESEARCH ACTIONS” GCDAMP SCIENCE ADVISORS

This Science Advisor review surfaces several issues and concerns with the proposed Non-Native Fish Control Plan. It also cites several important contributions of the plan. We understand the authors desire to emphasize research and monitoring approaches in this plan due to existing uncertainties. However, this could have been accomplished while placing the primary focus on non-native fish control activities.

Following an adopted procedure used in most of our reviews, we have provided general comments, specific comments and recommendations for revision of plan. This executive summary overviews our general comments and recommendations.

General Comments

Although much of the information necessary for an effective control plan exists in the document, it does not have appropriate context, organization and balance. Of particular importance is the omission of a general strategy for this program of work that speaks to its overall goal, processes for determining the key problems to address, areas of priority focus, balance of management and science required, integration with other ongoing programs, etc. As noted above and proposed by the authors, it is drafted more as a research and monitoring plan, rather than a Non-Native Fish Control Plan supported by research and monitoring activities.

The issue of length of the planning cycle to produce a short term and long term control plan is a concern. Although predation surfaced as a perceived critical threat in the 2002-2004 period, the GCMRC response for a final control plan seems to extend from 2004-2010, with a short term plan in 2009.

The proposed schedule and steps in the current planning process could benefit from redesign. The SAs accept the fact that the short term plan may better inform the long term plan to be completed in 2010. However, we feel the gains will be marginal with the limited funds proposed for science activity, especially field science. We propose GCMRC consider an alternative approach, wherein a single Fish Control Plan would be completed in 2009 with short term and long term management and science elements. We

feel this approach may better support the FY 2009-2012 management and science direction of the GCDAMP.

The authors provide good treatment of issues, methods and relative success in controlling non-native cold water fishes. This is demonstrated in sections on Rainbow Trout and Brown Trout. The text presents significant less certainty with respect to control of non-native warm water fishes, reflecting appropriately the knowledge in this system.

The plan provides reference to other ongoing GCDAMP management and science fish biology programs, but the text is insufficient in clarifying the linkages and integration that should occur across these programs to best benefit non-native fish control now or in the future. To be effective, integration of management and science programs should be articulated in both the overall strategy as well as individual non-native program elements presented.

The plan lacks specific discussion of resource needs, especially budget needs. Information is necessary for transition of science application to management control actions, who is likely to complete control actions, external budget needs, and all contingency and anticipated new GCMRC research and monitoring needs.

Inclusion of the contingency plan is an important element of the document. The SAs agree with GCMRC in its review request that this element needs more development. The approach needs leadership of management agencies and tribes to craft appropriate public relations, rapid response control, triage, and monitoring assessments.

Recommendations

Several general recommendations are proposed from this review. The control plan should be revised to respond to general concerns raised in the review as follows:

- Presentation of an overall management and science strategy is necessary to effectively integrate this program into the overall set of adaptive management activities of the GCDAMP and associated agencies and tribes.
- The plan needs to better relate the collaborative effort of managers and scientists who developed the plan, i.e., managers and scientists from TWG and GCMRC, including authorship.

- The length of the overall planning process to develop short and long term plans needs to be reevaluated and shortened as possible.
- The plan needs to be revised with the objective to have non-native management control actions as the primary focus of the plan and monitoring and research as support activities to insure best control approaches are implemented.
- The plan should more clearly articulate linkages and integration of proposed management and science actions to related activities occurring in other GCD AMP and agency affiliated programs, especially these related to fish biology, fish control, i.e. food base, near shore ecology, translocation, etc.
- GCMRC and TWG should reevaluate their proposed two plan approach. An alternative would be to develop one plan in 2009 that incorporates short and long term management and science elements for the period 2009-2012. It would of necessity have to have a strong monitoring program with supporting science in the initial four years, is 2009-2012. Most of the information necessary to revise this plan exists either in the plan or referenced documents.
- We concur with GCMRC that a pilot experiment of various control and monitoring approaches for catfish should be pursued. Carp should be added to the pilot. Both are proven effective warm water predation fish.
- GCMRC and TWG should articulate the projected management and science resource and budget needs over a decade period.
- The contingency plan needs to be better developed with significant leadership of TWG resource management agencies.

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GCD AMP SCIENCE ADVISORS

INTRODUCTION

The Science Advisors conducted this review from the perspective that it represents a part of the overall biological management and science program of the GCD AMP. That is, GCDAMP, Tribal and federal and state government agency biology programs are now individually and collectively addressing many parts of the interacting factors affecting native fish, i.e. competition, habitat, food base, predation, pathogens, etc. In previous reviews of some of these management and science programs the SAs have stressed that the programs (both individually and collectively) need to express more integration in science and management questions addressed, stated objectives, hypothesis, research design, management activities, etc.

The SAs have referenced in past reviews areas of science and management where integration is occurring and where it is not occurring. This review follows this established approach by the SAs. It most often addresses general issues, and references activities by both managers and scientists that need to express more integration.

REVIEW PROCEDURES

The SAs both understand and appreciate the proposal by GCMRC to first develop a short term plan to develop more knowledge and management experience, and then a longer term plan to apply this increased knowledge. However, concern exists over a planning process that is proposed to extend over 6 years; i.e., 2004-2010. We recommend procedures to shorten the process.

The SAs addressed this review with the understanding that a comprehensive non-native fish control plan was desired by the AMWG in their October, 2004 request to GCMRC as follows: “Consensus Item: Authorize funds for workshops, and direct GCMRC to further develop warm water species plan with TWG. The workshops include GCMRC workshop as described in the prospectus for warm water species research and participation in the Upper Basin Recovery Implementation Plan workshop on non-native

fish control”. The Non-Native Fish Ad Hoc Group and GCMRC have characterized this activity as development of a Non-Native Fish Control Plan.

As such, in this review the SAs looked for balance in treatment of both management control and science direction.

The SAs also continue to look for specified approaches to improved management and science integration, while realizing GCMRC needs to implement its programs under separate RFPs, cooperative agreements, etc, which challenge a predefined integrated approach. Yet, there are explicit interrelationships of habitat, food base, competition, predation, pathogens, etc. in biology programs that can best be approached through integrated science and management programs.

As in past reviews, the SAs provide in this report both general review comments and specific review comments, followed by recommendations. An Executive Summary is also provided to capture the salient findings of the review.

GENERAL REVIEW COMMENTS

Overall Strategy

The document does not effectively present an overall strategic procedure for approaching this problem, excepting that it will step through a two-tier planning process, i.e. short term/long term plan. An overall “control plan strategy” is missing. Lists of activities are provided that could be pursued, but an actual control plan is not developed. It does develop some tactical and operational elements quite well, but they should proceed from and clearly support the overall strategy. We are not suggesting that a strategic plan be written, but early on in the control plan a strategy should be presented. Some elements to consider for this section follow.

- Specification of the overall problem or problems by GCMRC and TWG. What is to be accomplished by scientists, and managers, both in collaboration and, individually. What native (s) are most threatened, what age classes, where? What non-natives are the greatest threat, where?
- Specification of general management control approaches. What approaches are proposed by what groups and over what time periods? What pilots are proposed?

- Prioritization of competing options needs to occur based on some objective criteria.
- Specification of general science and monitoring needs. What programs are necessary, probable lengths, necessary integration?

Without an overall strategy the reviewer can not effectively evaluate the lists of potential approaches. These assessments should have been accomplished by the authors. Further, the organization and content of many parts of the report fails to convey a logical plan of needed actions, be they management control or science activities.

Length of Planning Process

Concern exists over the length of the planning process. In 2001/2002 GCMRC expressed in their proposed long term experimental approaches a need for increased predation assessments and potential controls. Fish biologists, the SAs and AMWG has expressed the need to understand and control predation, especially from cold water pacifivores such as rainbow and brown trout.

The 2002/2003 assessments of declines in the HBC adult population heightened concerns over predation and as noted in the plan resulted in the Non-Native Fish Ad Hoc Group. This was followed by AMWG's formation of the Humpback Chub Comprehensive Plan Ad Hoc Group to respond to the presumed highly threatened HBC population.

When GCMRC was asked in 2004 to develop the control plan collaboratively with TWG it would seem to have an attached urgency. As such, concern exists over the seemingly extended period to develop the control plan. A two year development period would have seemed more reasonable.

We understand GCMRC proposes to complete a control plan in 2010, using the intervening space, i.e. 2004-2010, to develop improved knowledge outlined in the proposed short term plan. The SAs encourage GCMRC to reevaluate this two step procedure for the following reasons.

1. A control plan completed in 2009 with more definitive control related actions (management supported by science) would be helpful to inform fiscal year 2010/2011 planning.

2. Releasing a plan in 2009 and updating the plan in 2012 would bring this effort more in line with other GCDAMP management and science planning.

Balance of Management Control and Science Activities

It is presumed AMWG directed a collaborative GCMRC/TWG approach to incorporate all ongoing and planned activities of both managers and scientists regarding non-native fishes, and selected native fishes. Yet, there is limited specification of management controls and discussion of the collaborative efforts with TWG and resource managers to define the needed controls. We are aware that managers and scientists are collaborating in the Non-Native Fish Ad Hoc Group and important recommendations and planning are formulated in the group. Also, very critical non-native control activities proposed by the Humpback Chub Comprehensive Plan Ad Hoc Group are considered in these discussions. However, these management/scientist discussions are not documented as potential management controls for implementation. Management planning and management controls are not made an explicit part of the plan in balance with science proposals.

As a non-native fish control plan, this document appears improperly specified. It is understood that AMWG's direction to GCMRC in 2004 was to develop a Non-native Fish Control Plan so that existing and/or potential future impacts of predation to Humpback Chub Populations could be mitigated. As written, this document does not present adequate focus on proposals for management control activities.

Any control plan, short or long term must focus on management control actions. Monitoring and research is critical as regards how it effectively supports the control approaches. In the plan it is necessary to specify what management and science actions are needed to eliminate, reduce, or mitigate defined problems. These could be defined for both the short term and long term. All actions identified need to be placed in some sort of priority system by both managers and scientists. In this case, it may help to ask "if and only if" questions. And all necessary short and long term research and monitoring to support the program must be specified. These objective processes may have been followed, but it is not documented well in the text.

Identifying Potential Impactors and Referencing Other Programs

Anticipating all potential impactors and surprises is important in developing control plans. This issue is raised and addressed, but could be refined. There is a very great danger of ignoring potential adverse future effects that may be caused by nonnative predator fishes that are not very abundant now. In this document Table 1 lists "dominant" nonnative predator fish by reach. Thirteen potential nonnative predator fish have been identified in the CRE, but all are not addressed here. Only 7 are presented in Appendix A. Projected future changes in water temperatures or flows in Grand Canyon might allow one or several of these other non-natives to proliferate rapidly.

The key in this assessment is to begin to focus on what would be considered to be your predator fish of highest risk and habitats of highest risk. Of these what fish and habitat areas create highest threat to HBC? We assume this objective process was followed to identify catfish as a target species. We do not disagree with a focus on catfish, and in fact would suggest carp also be considered in a pilot control activity.

It also seems there is limited concern that some new fish from the LCR or other source might also become a problem, since they are not fully addressed. Perhaps these risks can be minimized in the short term, but they should not be excluded. In discussions of long term needs these threats certainly should be identified and the risks evaluated. Since no risk assessment is cited we presume it is in planning. An assessment needs to be referenced or completed. The SAs recommend the document be revised to address the above concerns.

This document could be strengthened by acknowledging nonnative fish control problems and control efforts in the upper basin, where fish control has progressed from strategic planning to site specific actions. It would help the rewrite of this document to evaluate a process that has already occurred in the basin with the same fish species.

The first strategy in the upper basin was to identify the major nonnative fish issues and problems, and then consider management controls, science strategies, potential problems and conflicts in each area, and resolution in each instance. Also, all known and potential non-native predator fishes were evaluated for how they might threaten the existence of each native fish, to identify high priority areas for implementing control areas, etc (Tyus and Saunders, 1996).

The authors might also benefit from interactions with authors who have conducted at least informal risk assessments of some of these species i.e., Valdez and Speas (2007). We do feel the paper does a good job of reviewing ongoing cold water fish control initiatives, although the purpose, need, and effectiveness of these projects and how they specifically support short term control of the non-native fish is not always clear.

The reality of this program effort is adaptive management, i.e. test, evaluate, revise and test again. Focus on the warm water predator of greatest threat. Also, focus early tests in areas where warmer water is more available. Use coarse grained evidence from distribution change, presence/absence and juvenile trends as guides.

Use of a Two Plan Process

The authors propose that the justification for having this short term plan is to obtain more information through monitoring and research to more clearly establish improved control efforts for the 2010 Long Term Control Plan. However, many areas of uncertainty are presented that have profound effect on understanding non-native fish impacts, including gear effectiveness, sampling effectiveness, remote sensing effectiveness, defining non-native/native interactions, etc. Only limited field science activities are proposed to gain these resolves in 2009. Due to their complexity and proposed science activity, it would seem that they would have only limited resolve even by 2012.

The SAs encourage GCMRC to consider an alternative approach. Revise this document and submit it now as the final control plan, listing appropriate pilot management control actions and science needs for the periods 2009-2012. Propose a significant revision of the plan in 2012. It would seem three to five years of learning in the areas identified will be needed to significantly advance new non-native fish control measures.

Program Integration

Issues of program integration arise in two areas in this plan. The plan should specify an agreed upon priority list of non-native fish management controls or pilot programs control for the next 5-10 years. These selections should reflect an integrated management and science assessment of options, associated risks, knowledge, costs, etc.

We cannot determine if these assessments by the GCMRC and TWG occurred, because no priority lists of control actions are proposed.

Currently non-native fish control or pilot actions are occurring in the mainstem and tributaries, i.e. mainstem RBT control, tributary BT control, mainstems warm water species pilot control, etc. One cannot determine from information presented if these actions are resulting from integrated planning. Further, research and monitoring activities by GCMRC, NPS, ADF&G, etc. related to support of non-native fish control are occurring on habitat, food base, predation, competition, etc, but it is not clear how it is all integrated. Some concept of GCMRC's integration of fish biology science is presented but it lacks clarification of intent.

Schedule, Resource Needs and Budgets

The control plan does not clarify anticipated resource requirements for the proposed program. A separate section on resource needs including budgets is necessary for appropriate evaluation of the plan.

The presented short term plan is proposed to fit into a long term plan, but it fails to provide any schedule of actions for the transition. The plan of actions should clarify what is to be accomplished next year and the year after. The schedule was not presented.

Resource requirements to launch a control plan could require significant new expenditures by state game and fish agencies, federal resource management agencies and tribes. As such, their leadership, potentially through the TWG, Non-Native Fish Ad Hoc Group or other entity is needed to define actions and associated costs. These evaluations may have occurred, but they are not presented in the plan. Also, potential expenditures to respond to additional research and monitoring needs are mentioned, but actual projected costs for those programs are not provided.

Lacking even first estimates of budget requirements it is difficult to contrast and compare various management control needs and science needs for this program. A table of ranges of potential costs for alternative programs over a five or 10 year planning horizon would be useful.

Contingency Plan

Evidence does exist that threats from exotic fish to native fish can materialize quickly and overwhelm the ability of management agencies to respond in a timely

manner. As such, incorporation of contingency planning in this document is critical. However, drafting of this section seems to lack critical leadership of management agencies serving on the TWG. Further, it could be significantly improved by development of or referencing an appropriate risk assessment of non-native fish and native fish interactions in the CRE and its main tributaries.

SPECIFIC COMMENTS

This section identifies review comments, concerns, and suggestions by the science advisors on specific sections of the plan. The final section of the review will present recommendations that respond to general and specific comments.

P1, P1, S2

There needs to be a paragraph in the executive summary and a page in the text that addresses the AMWG strategic approach to the issue of Non-Native Fish Control. In past GCD AMP programs habitat manipulation has also been a primary factor used to control non-natives; i.e. flows, temperature, sediment etc. Further, other management policy experiments and even management actions have also occurred. Concern exists that this plan is oriented primarily to science, whereas its focus should be on obtaining desired resource response, i.e. non-native control. The 2004 charge from AMWG to GCMRC as presented in the plan (p6, p2, s1) was to “develop a management plan to control non-native fish populations and reduce the populations negative effects on native fish in Grand Canyon.” The emphasis of this plan then needs to be management control methods for non-native fish.

P1, P2, S3

This plan should be focused on two clear outcomes, defining best available current controls supported by management science and defining new science needs and new management policy tests to improve control capability.

The Executive Summary and Plan needs to begin with overall strategic statements of the problem and useful management and science approaches to non-native control that captures competition/predation/habitat relationships in a space/time format. Focus should exist on mitigating impact to native fish (HBC) species with science based management approaches. Since the LCR native fish population is the most critical group for protection, it would seem to have primary focus in the plan.

P3, P1, S2

The entire approach should be system based with a focus on identifying primary non-native fish and habitat locations of concern. This statement seems to focus on the concept that non-native fish introductions during and after the dam construction period are the primary source of today’s populations. Is that true? Historically introductions began prior to the 1900s and some became established, i.e. several before the dam closure. Some have had long term impact, i.e. carp.

P3, P2, S4

This plan should identify the immediate management actions that are being applied and can be applied in all major areas of native fish threats in the near term. We agree that this plan needs to have appropriate focus on monitoring and research, especially to identify best control measures. However, if it is a control plan, its primary thrust should be to evaluate GCD AMP implemented and proposed management actions and policy assessments and provide some assessment of their potential short and long term contributions to non-native fish control. We agree that short term monitoring and research actions help define most effective short and long term non-native fish control methods. However, in balance the focus of any control plan has to be management actions, pilot control projects, policy experiments, and management assessments etc that are currently and will be the on-going basis for non-native fish control.

P 3-6

Although pages 3-6 have weaknesses as defined above, they do provide some tracking from GCD AMP issues, goals, objectives, information needs and strategic science questions through AMWG planning and direction (i.e. Non-Native fish Ad Hoc Group) through a discussion of science and management, studies, assessments, actions etc. However there is limited focus on defining explicit control methods for use and evaluation during the period 2008-2012.

Concern exist that work by the HBCCP Committee that receives minimum attention in defining areas of non-native control. Their contributions are mentioned briefly later in the text but not nearly at the prominence related to their contributions.

Control approaches to the trout species are pretty well known permitting specification of these as proposed control actions. Proposed controls for warm water fish are less certain but could be proposed as pilot policy experiments. The focus should be on predators of greatest threat. Catfish and carp are good candidates.

6-11 Bullets

These specific examples are declarative in specifying GCMRC/AMWG/TWG responses to the needs specified by the Non-Native Fish Ad Hoc Committee. Many of the examples are also overall AMP (GCMRC/AMWG/TWG/SAs) responses to the HBC Comprehensive Plan (HBCCP).

A concern exists that this plan does not provide a summary or brief assessment of several of these accomplishments, i.e. channel catfish monitoring and control, removal methods testing in Shimino Creek and LCR, tests of fish tracking technology, etc.

P7 Scientific Assumptions

The lists of assumptions are certainly appropriate. Did the contributing scientists consider the following assumption?

“The impacts of non-native fish predation/competition on native fish can be more significant when interacting with other potential life cycle effectors, i.e. flow regimes, water quality, pathogens, etc.”

P9, P2

The issues of gear effectiveness and sampling designs are factors that will dominate the potential effectiveness of the fish control program. As you state in P9, P3, “The ability to capture non-native species and detect changes in their populations and distribution is vital to directing non-native control. Predictable catchability of exotics is required to provide any reliable assessment of their impacts on native fish in this system. Yet, catch gear performance is largely unknown making assessment of sampling designs difficult. Brief references are made to unpublished data from several years since 2002 that address this issue. Yet, none of these data or summaries are presented. At the recent GCMRC Conference the San Juan RIP representative referenced success with catfish removal in that system. Yet, an assessment of success in the San Juan is not referenced in this plan. Since this issue is so basic to control success a more complete knowledge assessment (science and management literature) would seem relevant here.

P11, P2, S2

It is unclear what a “Boot strapped CV” defines. Also, in this paragraph you reference (P11, P2,S5) “extensive sampling”. Do you mean “intensive sampling”? In P12, P1 and 2 the discussion of use of electro fishing for brown trout is not clear. It characterizes electro fishing as the most “viable option” for these species but then characterizes it as difficult to capture the species, making the method “logistically infeasible”. In these sections you also reference that electro fishing may be adequate for smallmouth bass and walleye because of their vulnerability to the method, citing unpublished AG&F data. But later you state that capture probability for the two species are unknown. You also reference that boat electro fishing is not adequate for small bodied fish, but in P12, P4 you cite Korman’s and others (2006) work with boat electro fishing (slow shocking) as being effective on young and therefore assumed small body fish.

It is obvious that there is significant uncertainty regarding gear effectiveness. You note this early on. However, given that fact, discussions as noted above can be confusing. When you cite a particular method as being “viable” one might conclude that it is fully evaluated and known to be “effective”, given whatever criteria being used to determine effectiveness.

P16, P2 and 3 Seining

The general statements regarding application of this method to back waters provide some insight into the protocols, but it lacks clarity.

It is stated that one pass is made and captures are reported per area seined. Large and small backwaters seemed to be treated differently. Is there a specific protocol developed from capture assessments?

P16, P4 Channel Catfish

Catfish is a most difficult species to control given all methods applied. Stink baits have enhanced captures in net and hook and line applications in many regions. It would be expected to improve catches in the CRE. You cite seining to be effective and electro fishing not to be effective but no specific assessment data is provided. Again, at the recent GCMRC conference the San Juan Group reported effectiveness on catfish removed. What methods are they using?

P17, P2, Table 3

No effectiveness assessments are provided for hoop net sampling in the LCR, except to note it is ineffective on catfish relative to angling. Do data exist to develop assessments of capture effectiveness?

P18

The discussion of the Bright Angel Creek brown trout removal programs appears to be supported by more analytic assessments. However, throughout the sections on methods different descriptions of effectiveness are used, i.e. capture probabilities, removal effectiveness, abundance measure, distribution, coefficient of variation, relative abundance, etc. Some have been explained, i.e. coefficient of variation and capture probability. Others have not. Explanations of effectiveness measures would be helpful.

The qualities of the assessments that have been completed present a measure of control effectiveness similar to the mainstem RBT control program of 2002-2006. In both cases it is apparent that even with an aggressive control plan continued production of adult spawning RBT and BT is occurring. This BT control program assessment in Bright Angel Creek and the mainstem RBT assessments seem to point to the need for continued control programs for those two predators while evaluating methods for improved control effectiveness to reduce program costs.

P19, P1 & 2; Shimano Creek

Whereas the presentation on Bright Angel Creek provides assessments of methods and control plan effectiveness, this section refers the reader to the NPS for data assessments. The data needs to be provided by GCMRC in this plan, as well the findings on displaced RBT from clear creek in the 2005 high flows. Evaluation of methods effectiveness and flood displacements in tributaries is important to the overall control plan. As such, this assessment should be made more complete with NPS data.

P19, P3, Sonic Telemetry

As in other, sections with other methods, the assessment of this methodology presents both promise and significant problems. Of greatest concern is that assessments were conducted and cited but no data is provided to evaluate effectiveness. At least summary statements on data and assessments need to be included.

P19, Recommendations

The recommendations reference the annual “Non-native Fish Workshops” as a place where priority control efforts will be determined by fish scientists. Clearly scientist evaluation of what are the most scientifically appropriate control and science approaches is critical input to implementation of a management control plan. However, effective setting of priorities and plan implementation must of necessity contend with many non-science issues of law, policy, budget, agency authorities and responsibilities, etc. As noted earlier, this document should be proposed as a management control plan underpinned by all available science understanding. This document treats very lightly the primary role of managers in the control plan.

To the issue referenced above, i.e. setting priorities on control approaches; it would appear that would be the role of managers. And would address much more criteria than listed at the end of paragraph 1 on page 20.

Following are comments on your management and science recommendations.

1. In your studies of natal origins using otoliths, isotopes, and larval drift samples for native and nonnative species, advantage of sampling being done by the Nearshore Ecology Project. Every fish collected by them provides a sample point. Non-natives are likely to be less abundant so each caught is useful. That helps define the history of habitat overlap. In addition, their catches tell you about community composition and habitat overlap through time and space.
2. For your study to identify sources of juvenile and adult nonnative fish such as tributary inflows, dam passage, and illegal stocking, you might want to delay this in accord with contingency planning for control projects.
3. Your large-scale sonic telemetry study is of moderate priority. It's costly and takes lots of time for the data return. Launch a pilot study first.
4. Laboratory flume experiments to investigate mechanisms by which nonnative fish negatively affect juvenile humpback chub might provide some insight. Unfortunately flume studies tell you what fish do in flumes. This should be lower priority.
5. Catfish capture and monitoring studies using catfish hoop nets and stink cheese bait should produce results. Although much trial and error is involved. Pursue immediately. Focus on the LCR and its proximate mainstem. This looks like a candidate for Control projects. We would suggest you also try other baits and techniques known to catch carp.
6. Your small-bodied nonnative fish and YOY capture and monitoring study using slow-shocking techniques (nearshore ecology) could have promise. Again, coordinate and collaborate with NSE research and research at/above Lee's Ferry. In the simplest case, have them provide non-natives they catch and/or the data on catch rates. Presence/absence is your first source of insight.
7. The project to increase sampling intensity around Lees Ferry to attempt increased detection of newly invading nonnative fish species is a good idea. It's easier, less expensive and can be done more frequently than river trips.
8. The LCR project for continued pilot testing of catfish and carp capture methods in the Little Colorado River should be a high priority pilot control measure and could be considered a mini-policy experiment. It could become a control method that works.

P19, P5:

The work by Valdez and Spears (2007) (non-native fish assessments) is mentioned as the most advanced work on the subject. Yet, a summary of its findings is not presented to which readers can contrast the recommendations in this plan.

Pages 20-24: Monitoring and Research

In paragraph 1, page 20 the authors cite that this document “focuses on improving monitoring and research, core components of efficient removal systems”. We do not disagree that this should be an important element of the plan, but it exists to support selection of appropriate control methods, and they should be the primary focus of the plan.

The following table provides comments on the proposed recommendations on Monitoring and Research

Table 1: Comments on Recommended Monitoring and Research	
Recommended Science Area	SA Comment
• Spring Area Identification	Agree to its importance
• Source Identification	Agree, especially as relates to tributaries
• Fish Sonic Telemetry	Agree, and should be part of remote sensing program
• Remote Pit Tag Detectors	Agree, Should be part of new remote sensing program. Greater specification of this study would be important to understanding its value. Most important are environmental condition determination.
• Channel Catfish	Agree and propose carp also.
• Small Bodied & YOY	Could this study be better addressed in a test stream environment?
• Lees Ferry	This is considered the least favorable CRE segment for warm water non-natives. Would segments of the lower river be better?
• Mechanical Removal LCR	A question relates to the statement; “warmer water is highly correlated with___ decreased non-native abundance! Is this a known validated finding or an anomaly associated with mechanical removal? Agree that RBT should be maintained at low level, i.e. 10-20% of 2003 levels.

P 24; Chemical Renovation and Barrier Construction

These proposed management procedures, although seemingly not feasible for the CRE or LCR, could afford management and science restoration opportunity for tributaries such as Bright Angel, Shimino, Clear Creek, etc.

P 25; LCR

The critical importance of the LCR to HBC restoration in the CRE would warrant an aggressive program of Non-native removals from the LCR if no monitored impacts occur to HBC.

P 26; Bright Angel Creek; Shimino Creek

Brown trout is one of the most effective predators of HBC in the CRE. The SAs agree that aggressive control and monitoring assessment should be continued in Bright Angel and Shimino Creek.

P 265; Reporting Procedures

Noteworthy in this document are references to other agencies for data and assessments that should be included in this document. The SAs agree that all assessments should be available to the AMP in a timely manner.

P27; Annual Non-native Fish Workshop

The SAs concur that this would be a critical element to advancing the Non-native fish control plan. It is noted that it should include cooperators and topic experts. Other text references imply a strictly science based workshop and participants. Because the proposed program requires involvement and direction of managers, the workshop(s) should involve management oriented programs and managers, especially those having mandated authorities in fisheries and fisheries habitat management.

P 27; Prevention and Public Outreach

As noted these are critical elements of resource management programs in very public places such as Grand Canyon. Although having the GCD AMP public outreach AHG perform some of these activities has merit, i.e. draft and print information pamphlets. These efforts are more effectively handled by NPS, USBOR and USGS who have professional staff. Perhaps the POAHG could be utilized to participate in planning activities of the critical state and federal agencies.

P28; Contingency Planning

It would appear at first reading that the contingency planning is incorporated to address required interagency management actions for non-native fish control. It reads as though one would not take any management actions unless identified interagency thresholds were exceeded. The discussions in the contingency planning section would benefit from findings of the work by Valdez and Speas (2007) referenced earlier.

Triggers regarding associated expansion of different species might be effective where species assessments exist. Over the next 10 years these might be viable for some species as data and assessments are improved. Changes in distribution, species composition and length composition (ages) were discussed earlier in the plan, not necessarily as trigger elements of a control plan, but in similar context to the points made in the contingency planning sections.

Targeted flow manipulation to control non-natives, as other contingency recommendations, appears to be proposed to react to an identified rapid expansion by an exotic. They would occur only when comprehensive knowledge of native and non-native life history exist, data that is limited to the CRE.

P30; Contingency Planning Fund

A Non-Native Fish Control Fund is certainly critical to insure science support for long term success of this proposed plan. Otherwise, as noted, science funding could be directed inappropriately to management activities. This issue has been raised in several

SA reviews and in TWG and AMWG discussions, but never discussed with the objective of defining a potential solution, i.e., when is an action a “management action” and how is it to be funded. These discussions have surfaced when attempting to address management actions, Recovery Implementation Programs (RIP), desired future resource conditions, and the long term experimental plan.

Due to the extensive uncertainties associated with non-natives it would appear that a contingency plan should address only the event or events of highest probability and greatest impact. Use of the Valdez and Speas assessment might assist in the approach.

RECOMMENDATIONS

A strategy needs to be developed for this program and appear as the first section of the plan and the first paragraph of the executive summary. Several aspects of the strategy are important to clarify; exactly why the program is needed; who will implement the program; what are the specific issues to be addressed; what are the primary procedures (i.e., management controls, science) proposed and who will conduct them; how will it be funded, etc. For example it is assumed this is a collaborative program of GCMRC and TWG, but TWG input seems minimal. A Non-Native Fish Control Plan implies management control actions as the primary focus, but it is not the focus of this plan. The strategy can clarify this approach. The strategy can be developed in three to four paragraphs, and is necessary to inform other sections of the plan.

We recommend that the proposed second phase of this planning process for drafting a long term plan be revised. GCMRC should instead consider revising this plan to a final plan in FY 2009 that will cover the period 2009-2012. Potential approaches to respond to this recommendation exist in the following recommendations.

The focus of this plan needs to be changed to management actions for Non-Native Fish Control. Research and monitoring programs necessary to better inform these management activities in the short and long term are critical elements of the plan, but should be designed to support proposed management control activities.

The primary justification to draft two plans i.e. short and long term appears to relate to significant uncertainties and the need to conduct monitoring and research to better inform a “long term” plan. We agree uncertainties exist and better science will improve control actions. However, this selected approach creates an extended window where assumed critically needed focus on non-native fish control methods and tradeoffs are not being deliberated, an important element of adaptive management.

Revising this plan to focus on non-native fish management control actions and research and monitoring programs for 2009-2012 could accomplish most objectives prescribed for the currently planned short and long term plans. It could also permit focus by managers on implementation of control actions pilot control projects, needed science support over a longer term, required cooperation by resource management agencies and decisions on agency budgeting of these control measures.

Text needs to be added to provide greater clarification of how the proposed GCD AMP non-native fish management control program will be integrated with other existing or planned agency and tribal programs in fish resource management. The text should also address how this program would be integrated with the planned HBC Recovery Implementation Program (RIP) should it be initiated.

The segment of the plan addressing needed research to refine, enhance and support management control activities needs to be effectively integrated into the comprehensive biology programs currently in progress and planned at the GCMRC, especially the fish ecology programs.

The general organization of the proposed plan by GCMRC could be revised to provide more specificity to its primary objective i.e., proposing actions for non-native fish control. Major sections of the text could include:

- Need and context for a Non-Native Fish Control Program
 - Risk to native fish habitat populations
 - Responding to legal mandates
 - Improving ecosystem conditions
- Strategy for Non-Native Fish Control Program
- Management and science program integration
- Proposed short and long term control programs and supporting science
 - Control Programs
 - Research and monitoring programs
- GCDAMP, agency and tribal implementation schedules
- Resource requirements
 - Management agency and tribal management control costs
 - GCDAMP cooperative science programs and budgets needs

- Contingency plan and budget needs

The proposed planning of resource requirements and budget needs for implementation of the program should address the transition required from science activity to management actions. It should clarify individual agency program authorities and budget responsibilities, and how resolve of this issue would enhance program success.