

Gila River Basin Native Fishes Conservation Program

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Abstract—The Gila River Basin Native Fishes Conservation Program was established to conserve native fishes and manage against nonnative fishes in response to several Endangered Species Act biological opinions between the Bureau of Reclamation and the U.S. Fish and Wildlife Service on Central Arizona Project (CAP) water transfers to the Gila River basin. Populations of some Gila River native fish species are rare in the wild and appear on the verge of extirpation. The CAP Program provides monies to undertake and support conservation actions for five priority fishes and other native fishes in the Gila River basin by implementing recovery plans. The Program will last 30 years, and provide more than \$16M. In addition, the Program provides monies to control and eradicate nonnative fishes and other non-indigenous aquatic organisms. Thus the Program is directed toward actions against nonnative aquatic biota where it interferes with recovery of native forms. Fund transfers from Reclamation to the Service began in 1997; about \$6.8M has been allocated so far and Reclamation will transfer about \$9.2M the next 17 years. One half of the funding is identified for native fish recovery actions, and one half for non-native aquatic biota control actions. Multiple conservation and recovery projects benefitting native fish in the Gila basin have been funded so far. In addition, barriers and management against nonnative species have been funded and completed.

Introduction

The Gila River Basin Native Fishes Conservation Program (GRBNFCP) is an outgrowth of reasonable and prudent alternatives (RPAs) developed by the U.S. Fish and Wildlife Service (Service) and U.S. Bureau of Reclamation (Reclamation) to prevent jeopardy to the continued existence of federally listed fishes resulting from operation of the Central Arizona Project (CAP). The RPAs were developed as part of a biological opinion (USFWS 1994) under the Endangered Species Act (ESA) section 7 consultation process (16 U.S.C. 1531 *et seq.*). The CAP is a Bureau of Reclamation constructed aqueduct that delivers water from the Colorado River to the Gila River basin in central and southern Arizona (fig. 1). Nonnative fishes and other aquatic organisms found in the Colorado River and elsewhere in the system can be transported via the CAP and released (actively or passively) into the Gila basin where they can negatively impact native fishes. The presence of nonnative fishes is now considered the primary obstacle to conservation and recovery of natives in the region through a myriad of effects including predation, competition, hybridization, and pathogen and disease transmission (Clarkson and others 2005; Hubbs 1955; Miller 1961; Minckley 1973, 1985; Minckley and Deacon 1991; Minckley and Marsh 2009; Moyle and others 1986; Williams and Sada 1985).

It was determined infeasible to prevent nonnatives from entering and escaping the CAP, so the RPAs were crafted to limit and mitigate their upstream spread into streams occupied by listed fishes. They called for construction of fish barriers to prevent upstream movements of nonnatives, monitoring to detect the presence and distribution of nonnatives, and funding to implement recovery plans of native fishes and control nonnatives. An RPA was also developed to educate the public about the values of native fishes and the problems that nonnatives create for them. The GRBNFCP is funded by Reclamation and is directed by the Service and Reclamation, in cooperation with the Arizona (AZGFD) and New Mexico Game and Fish (NMDGF) departments.

Here we discuss the two funding RPAs: recovery of natives (RPA 3) and management against nonnatives (RPA 4). The Program mission is to undertake and support conservation actions (recovery and protection) for federal and state listed or candidate fish species native to the Gila River basin by implementing recovery plans for those fishes. The two native trouts are specifically excluded, as they are the focus of other recovery programs. A strategic plan (USFWS and others 2007) identifies the long-term vision for the Program as well as broad goals and actions that are expected to be accomplished during the current 5-year period (<http://www.usbr.gov/lc/phoenix/biology/azfish/pdf/5yearstraplan2008final.pdf>).

There are five priority-listed native threatened or endangered fish species in the GRBNFCP: Gila topminnow *Poeciliopsis occidentalis*, spikedace *Meda fulgida*, loach minnow *Tiaroga cobitis*, Gila chub *Gila intermedia*, and razorback sucker *Xyrauchen texanus*. Other listed or unlisted native fish in the Gila River basin are also eligible for conservation actions. In addition, a one-time transfer of \$100,000 from Reclamation to the Service was made to fund conservation actions for the recovery of the threatened Chiricahua leopard frog *Lithobates chiricahuensis*.

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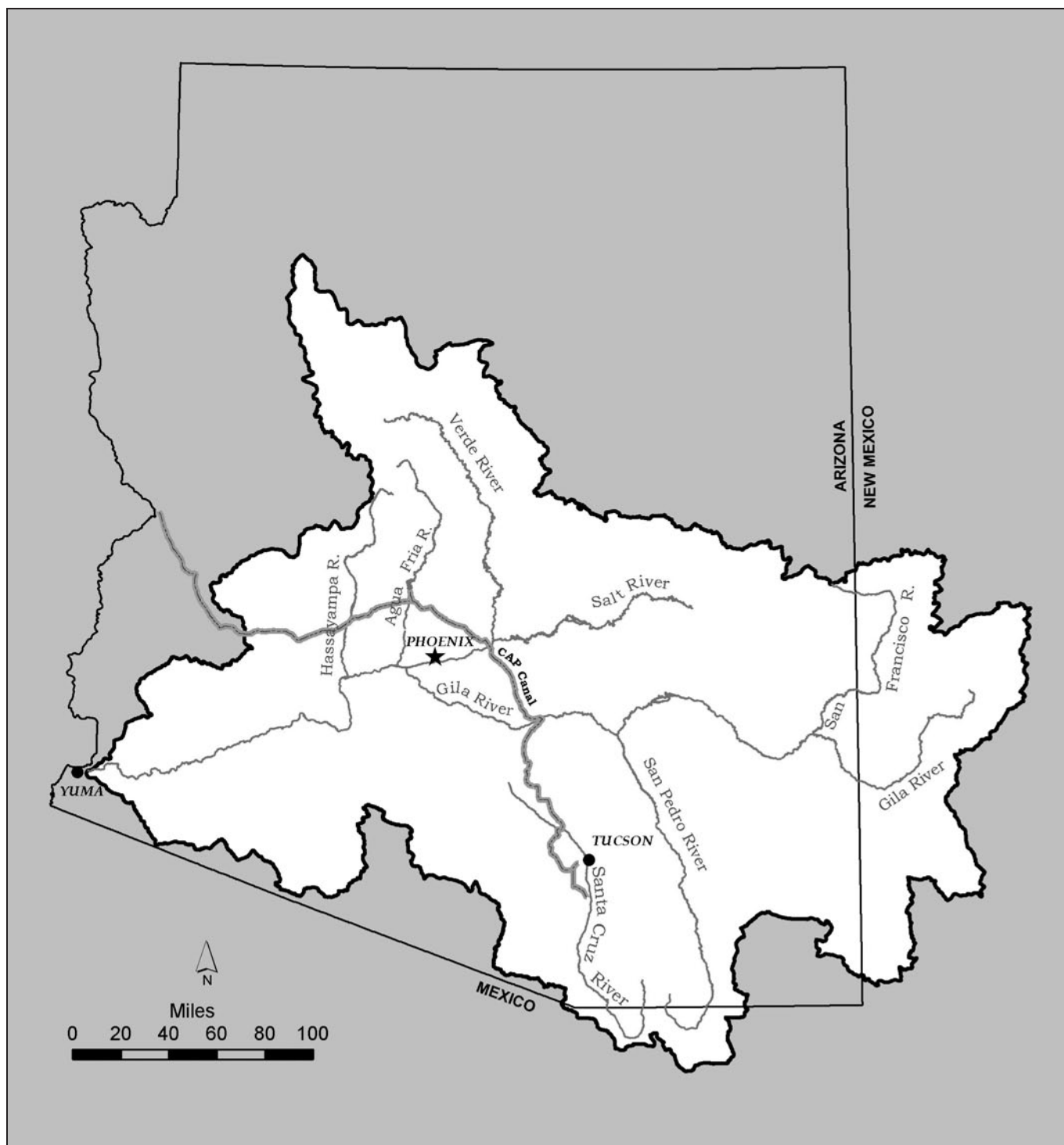


Figure 1—Map of the Gila River basin.

The principal goals of the GRBNFCP are to (1) enhance conservation status of federally listed and candidate fish species in the Gila River basin; (2) alleviate and diminish threats from nonnative aquatic species to native fishes; and (3) remove nonnative fishes that might enter the Gila River basin via the Central Arizona Project or associated pathways (USFWS and others 2007). While the focus of this Program is recovery of federally listed species, it is recognized that long-term

viability of protected species is accomplished only in the context of conservation of intact native fish assemblages and their associated environments.

Funding to conserve Gila River basin native warm-water fishes is limited. Monies from the Program are prioritized such that meaningful, achievable, and lasting conservation activities benefit native fishes according to recovery plan goals and other guidance documents (e.g.,

conservation agreements, habitat conservation plans, State Wildlife Action Plans, integrated watershed management plans, forest management plans, BLM habitat management plans). Highest priority projects for the Program are those that are necessary to (1) prevent extinction and stabilize populations in the wild, and (2) replicate rare populations in the wild. Actions needed to prevent extinction and stabilize populations in the wild include (1) construct fish passage barriers to protect existing populations, (2) control nonnative aquatic species above barriers, (3) establish new and maintain existing populations, and (4) implement other actions to remove immediate threats and thereby help prevent extinction. Actions needed to replicate rare populations in the wild include (1) safeguard streams for replication of rare populations; (2) where necessary, construct fish passage barriers and renovate streams; (3) undertake captive production, including development of propagation techniques; and (4) implement other actions to insure that rare populations are replicated and protected.

Additional priority is given to projects that (1) benefit the five priority species identified in the 1994 and 2008 biological opinions; (2) benefit multiple species, including all native fishes of the Gila River basin; (3) provide immediate on-the-ground benefit; or (4) address other activities pertaining to research or management that aid in conserving native fish populations and habitat.

Process

Reclamation transferred \$500,000 to the Service during the first 9 years of the Program, beginning in 1997. One half of that amount was for native fish recovery actions (RPA3), and one half for nonnative aquatic biota control actions (RPA4). The original biological opinion called for 25 years of transfers (USFWS 1994). Another biological opinion (USFWS 2008) contained conservation measures to fund the Program an additional 5 years, with annual transfers increasing to \$550,000. Thus, a total of \$16,050,000 over 30 years will be available under the GRBNFCP for the recovery of native Gila River basin fishes, and management against nonnative aquatic species.

The strategic plan (USFWS and others 2007) lists the process the GRBNFCP follows. The Policy Committee (Service, Reclamation, AZGFD, NMDGF) provides guidance to the Technical Committee, approves or rejects recommended projects, and deals with policy and political issues that may arise during implementation of the Program. Because the GRBNFCP is a federally funded program that implements a regulatory document, the Service and Reclamation make the final decisions on implementation if consensus cannot be reached with the State partners.

A Technical Committee comprised of one biologist from each of the above four agencies oversees project solicitation, evaluation, and recommendations for implementation. Ex-officio members are representatives from the U.S. Bureau of Land Management and the U.S. Forest Service. Ideas for original projects (called tasks) are based on recovery plans and are generated through discussions with ad hoc groups of biologists, agency, academic, and non-governmental organizations, private fish biologists working in the Gila River basin, and other entities as appropriate.

Once annual projects are selected, Reclamation transfers funds to the Service for disbursement to implementing entities. Some funds are retained by Reclamation for tasks they are better suited to conduct or contract (e.g., fish barrier designs), and the Service also has completed a few tasks. Tasks that are recovery or research projects require written reports; completed reports can be found on Reclamation's web page: <http://www.usbr.gov/lc/phenix/biology/azfish/projlisting.html>.

Overview

About \$6.8M has been allocated through fiscal year 2011; half to each fund. The Service has disbursed or spent \$2.6M for RPA 3 and \$2.2 million for RPA 4, and Reclamation has disbursed or spent \$1M for RPA 3 and \$1.1M for RPA 4. A total of \$9.5M should be made available over the next 17 years.

Early in the Program's implementation, individual tasks were funded separately, and were often less than \$25,000. The state game and fish departments that implemented most of those tasks had a difficult time maintaining dedicated staff with such piecemeal budgets, and the contracting process to execute so many tasks was burdensome. Over the past 5 years, tasks performed by the two state wildlife agencies are lump-sum funded under multi-year umbrella agreements that facilitate retention of dedicated and qualified staffs and reduces contracting overhead costs. This change has also reduced the amount of unobligated funding and the lag time to disburse funds.

Arizona comprises about 93% of the 212,000 km² Gila River basin drainage area, with the remaining area in New Mexico and a small fraction in Sonora, Mexico. However, the upper Gila River in New Mexico remains an important, interconnected stronghold for species such as loach minnow and spinedace, and approximately 23% of funding has been directed to the state of New Mexico (table 1).

When funding is broken down by subbasin (table 2), the upper Gila has received 22% of the funding, as has the Verde River subbasin. The Verde has received similar funding due to the considerable conservation efforts at Fossil Creek, which so far have included renovating the stream and removing nonnative fishes, and stocking native fishes. Almost a third of the nonnative funds have been spent on tasks in the Verde subbasin. The San Pedro and middle Gila subbasins have also been well funded when compared to other subbasins, due to projects at the Muleshoe Cooperative Management Area and Bonita Creek, respectively.

Expenditures directed toward the five priority species have been generous for all but razorback sucker (table 3). Conservation opportunities for this species in the Gila River basin are limited, as the most appropriate physical habitat has intractable nonnative fish issues (Hyatt 2004; Marsh and Brooks 1989; Schooley and Marsh 2007). There have been many tasks that benefited spinedace and loach minnow because their conservation status is of the greatest concern among the five priority species. These two species were recently uplisted from threatened to endangered status (USFWS 2012). Also, a key goal of three of our large restoration projects at Fossil Creek, Bonita Creek, and the Muleshoe Cooperative Management Area has been the reestablishment of those two fish.

Table 3 also shows that unlisted species received copious funding. This is largely because of the several projects that also support populations of candidate-for-listing roundtail chub *Gila robusta* (USFWS 2009) and headwater chub *Gila nigra* (USFWS 2006). Both species are second priority species under the GRBNFCP strategic plan. The Fossil Creek project alone involves the two chubs, and four other unlisted species. In assigning funds to each species in a multi-species project, we estimated how much each species benefitted from the project. Because the two chubs were already present in Fossil Creek, and have done well post-renovation, much of the project costs were assigned to them.

Table 4 breaks down expenditures by project categories and shows that recovery funds (RPA 3) were spent on basic recovery actions: repatriation or reestablishment (36%), creation and management of refuges (13%), and surveys (11%). We also funded research (23%) on the genetics of the roundtail chub complex (*Gila* spp.) and desert pupfish *Cyprinodon macularius*, and on propagation of chubs, loach

Table 1—GRBNFCP expenditures (000s) through 2011, by fund, by state.

Fund	Arizona	New Mexico	Unkown/NA	Total
Recovery	\$2,668	\$916	\$28	\$3,613
Nonnative	\$2,482	\$626	\$115	\$3,223
Total	\$5,150	\$1,543	\$143	\$6,837

Table 2—GRBNFCP expenditures (000s) through 2011, by fund, by sub-basin.

Fund	Upper Gila	Santa Cruz	Verde	Salt	San Pedro	Middle Gila	Lower Gila	Unknown/Unclassified	Total
Recovery	\$912	\$200	\$487	\$639	\$481	\$330	\$25	\$591	\$3,665
Nonnative	\$623	\$195	\$1,026	\$229	\$448	\$467	\$28	\$203	\$3,219
Total	\$1,535	\$395	\$1,513	\$868	\$929	\$797	\$53	\$794	\$6,884

Table 3—GRBNFCP expenditures (000s) through 2011, by fund, by species.

Fund	Gila chub	Razorback sucker	Gila topminnow	Spikedace	Loach minnow	Other listed	Unlisted	Total
Recovery	\$439	\$70	\$448	\$910	\$614	\$241	\$992	\$3,714
Nonnative	\$305	\$161	\$406	\$739	\$737	\$145	\$693	\$3,186
Total	\$744	\$231	\$854	\$1,649	\$1,351	\$386	\$1,685	\$6,900

Table 4—GRBNFCP expenditures (000s) through 2011, by fund, by project type.

Fund	Research	Repatriation	Refuges	Surveys	Data	Misc	Renovation	Book	Barriers	Program	Total
Recovery	\$874	\$1,342	\$488	\$425	\$212	\$308	\$74	-	-	-	\$3,723
Nonnative	\$311	-	\$55	\$276	\$20	\$106	\$1,782	\$45	\$601	\$68	\$3,264
Total	\$1,185	\$1,342	\$543	\$701	\$232	\$414	\$1,856	\$45	\$601	\$68	\$6,987

minnow, and spikedace. About 10 percent of the nonnatives fund (RPA 4) went to research, largely focused on new and innovative control mechanisms of nonnative species. Our investment in research hopefully will facilitate species management and implementation of recovery actions by this and other programs. Almost three quarters of the nonnative management fund went to stream renovations and fish barrier projects.

Recovery of Natives (RPA 3)

Tasks under the recovery of natives fund are intended to lead to conservation and recovery of Gila River basin native fishes, mainly through on-the-ground projects. One of the tasks that underpins the entire recovery aspect of the GRBNFCP is development of a hatchery to (1) house wild stocks of imperiled populations as insurance against extirpation in the wild; and (2) propagate rare populations to assist with replicating them into new, protected streams. We developed and expanded the existing Bubbling Ponds Native Fish Research Facility in central Arizona to suit the unique needs of the stream-adapted native fishes of the Gila basin. We first developed methods to culture GRBNFCP-emphasis species that had not previously been propagated in a hatchery situation. Next, we acquired samples from most of the

most-threatened populations as insurance against loss in the wild, and began propagating and replicating them into protected wild streams. To date, replications of loach minnow, spikedace, Gila topminnow, and desert pupfish have been made to seven streams in the basin, and many more are planned.

Some of the major support projects for these recovery actions funded under RPA 3 included development of a larval fish key, characterization of the genetics of the roundtail chub complex (*Gila robusta*, *G. intermedia*, and *G. nigra*) and desert pupfish, determination of propagation techniques for loach minnow, spikedace, and the three Gila basin chubs, and development of refuge populations for Gila chub, topminnow, and pupfish.

Management Against Nonnatives (RPA4)

Tasks under the management against nonnatives fund are intended to ameliorate threats nonnative aquatic species are known to have on Gila River basin native fishes. Foremost among these was support for construction of six fish exclusion barriers to protect existing or replicated populations of many Program-priority species, evaluation of potential to develop new piscicide formulations, and purchases and

applications of existing piscicides and detoxification chemicals for restoration projects.

The Future

Because more than \$9M will be available for native fish conservation in the Gila River basin in Arizona and New Mexico under the GRBNFCP, we expect to continue strong recovery programs and threat mitigation for these fishes. Additional species listed under the ESA could be covered under the existing program, or may require additional measures if those species' conservation and recovery needs are not met by the existing GRBNFCP. We will continue placing barriers to protect native fish and their habitats, augmenting and reestablishing native species, and removing problematic nonnative aquatic species by the most efficacious means necessary.

As a result of ESA section 7 consultation on AZGFD's federally funded fish stocking program, a significant conservation program is being developed (USFWS 2011). The so-called CAMP (Conservation and Mitigation Program) has similar goals as the GRBNFCP, but covers the entire State of Arizona. Over a 10-year period CAMP is to conserve and recover its priority species and mitigate threats to those species. It is expected CAMP will be funded \$500,000 annually for 10 years from federal Sport Fish Restoration Funds. Because only loach minnow is a priority species in both programs, CAMP actions will cover a broader range of native aquatic species and a larger area. These complementary programs should prove greatly beneficial for native aquatic species in Arizona and parts of New Mexico.

As demonstrated above, multiple conservation and recovery projects benefitting native fish in the Gila basin have been completed. The GRBNFCP has been the most significant funding source for warm-water native fish recovery actions in the basin for more than a decade. The Program will continue to be a significant contributor to this important endeavor.

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