

DRAFT Environmental Assessment

**Reestablishment of the Rio Grande silvery minnow in
the Big Bend reach of the Rio Grande in Texas**



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U.S. Fish and Wildlife Service**

September 5, 2007

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Minnow into the Big Bend reach of the Rio Grande in Texas.**

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Summary/Finding of No Significant Impact:

The U.S. Fish and Wildlife Service (Service), based on the best scientific and commercial data available, proposes to reestablish Rio Grande silvery minnow (see *Appendix A* for a list of scientific names) in the Big Bend reach of the Rio Grande in Texas and to designate portions of the Rio Grande and Pecos River in the Big Bend region as a “nonessential experimental population” (NEP) area pursuant to section 10(j) of the Endangered Species Act (ESA). With the experimental population designation, the relevant population is treated as threatened for purposes of section 9 of the ESA, regardless of the species’ designation elsewhere in its range. Threatened designation allows us greater regulatory flexibility in managing the species. Within a NEP designated area, for the purposes of section 7 of the ESA, Rio Grande silvery minnow would be treated as proposed for listing outside of areas administered by the National Park Service [Big Bend National Park and the Rio Grande Wild and Scenic River] and as threatened within it. The proposed rule, which will be published in the Federal Register, and this Draft Environmental Assessment define allowable take (harm or harassment) of Rio Grande silvery minnow within the 10(j) area.

With expansion and additional support, the current captive propagation program for Rio Grande silvery minnow can provide sufficient individuals for reestablishment in suitable habitat in the Big Bend reach of the Rio Grande. We anticipate releasing Rio Grande silvery minnow into this area until either: (1) an evaluation of the program shows the Needs of the Action (Section 1.3) have been met, or (2) the reestablishment of Rio Grande silvery minnow in potentially suitable habitat becomes highly unlikely. In addition to the preferred alternative, we analyzed the no action alternative, and considered two other action alternatives, which were eliminated from

detailed study. The preferred alternative was selected over the other alternatives for the following reasons:

- (1) It meets the purpose and need identified in this draft EA.
- (2) While it is true that consultation requirements would be lessened under this alternative, we believe that incidental take associated with otherwise lawful activities would not pose a substantial threat to Rio Grande silvery minnow recovery, as activities that currently occur in the NEP area would be compatible with Rio Grande silvery minnow recovery. Thus, the more stringent legal protections provided under an essential experimental population are unnecessary.
- (3) Landowners and managers are more likely to accept Rio Grande silvery minnow in the Rio Grande adjacent to their lands with the flexibility provided by a NEP designation, which allows us to build partnerships and explore potential habitat improvement projects with a larger group of landowners.

It is our determination that the proposal does not constitute a major Federal action significantly affecting the quality of the human environment under the meaning of section 102(2)(c) of the National Environmental Policy Act of 1969, as amended (NEPA). As such, an environmental impact statement is not required. A monitoring and implementation plan for this action is included in *Appendix B*.

Regional Director

Date

1.0 Introduction, Purpose and Need

1.1 Introduction

The federally endangered Rio Grande silvery minnow (see *Appendix A* for a list of scientific names) was historically one of the most abundant and widespread fishes in the Rio Grande, occurring from Española, New Mexico, to the Gulf of Mexico (Bestgen and Platania 1991). It was also found in the Pecos River, a major tributary of the Rio Grande, from Santa Rosa, New Mexico, downstream to its confluence with the Rio Grande (Pflieger 1980). The Rio Grande silvery minnow is extirpated from the Pecos River and also from the Rio Grande downstream of Elephant Butte Reservoir and upstream of Cochiti Reservoir (Bestgen and Platania 1991). The current distribution of the Rio Grande silvery minnow is limited to about 5 percent of its historic range and is only found in the Rio Grande between Cochiti Dam and Elephant Butte Reservoir in New Mexico. Throughout much of its historic range, the decline of the Rio Grande silvery minnow has been attributed to modification of the flow regime, channel drying, reservoirs and dams, stream channelization, and perhaps interactions with non-native fish and decreasing water quality (Bestgen and Platania 1991; Cook et al. 1992; Service 1999). Development of agriculture and the growth of cities within the historic range of the Rio Grande silvery minnow resulted in a decrease in the quality of river water caused by municipal and agricultural runoff (i.e., sewage and pesticides) that may have also adversely affected the range and distribution of the Rio Grande silvery minnow (Service 1999).

The various life history stages of the Rio Grande silvery minnow require low velocity habitats with a sandy and silty substrate that is generally associated with a meandering river that includes side channels, oxbows, and backwaters (Bestgen and Platania 1991; Platania 1991). Although

the Rio Grande silvery minnow is a hardy fish, capable of withstanding many of the natural stresses of the desert aquatic environment, the majority of Rio Grande silvery minnow consist of one year old or younger individuals (Bestgen and Platania 1991), with significantly fewer two and three year old individuals present at any one time. Thus, a successful annual spawn is key to the survival of the species (Service 1999; Dudley and Platania 2001, 2002b). More information about the life history and decline of the Rio Grande silvery minnow can be found in the final listing of the species as endangered (July 20, 1994; 59 FR 36995), the final designation of critical habitat for the species (February 19, 2003; 68 FR 8088), the Rio Grande Silvery Minnow Recovery Plan (Recovery Plan; Service 1999) and the draft revised Rio Grande Silvery Minnow Recovery Plan (draft revised Recovery Plan; Service 2007).

The term “Big Bend reach” refers to the portion of the Rio Grande in Texas, from Mulato Dam, east of Presidio, Texas, through Big Bend National Park and the Rio Grande Wild and Scenic River. “Big Bend region” is used to refer to the geographic area of the Big Bend reach and surrounding lands.

The Rio Grande silvery minnow is extirpated from the Big Bend reach and natural repopulation is not possible without human assistance (Service 2007). Reasons for the species’ extirpation in the Rio Grande in Texas are uncertain, but are believed to have been due to a combination of low flows due to drought and diversions, in combination with water pollution (Edwards 2005). The last documentation of a Rio Grande silvery minnow in the Big Bend reach of the Rio Grande was in 1960. However, the Big Bend reach has not experienced extensive drying since the drought of the 1950s and the continuing presence of members of the pelagic spawning guild (consisting of

fish species that, like the Rio Grande Silvery minnow, produce semi-buoyant eggs that drift downstream, e.g., speckled chub and Rio Grande shiner) (see *Appendix A* for a list of scientific names) is evidence that the Big Bend reach may support reestablishment of Rio Grande silvery minnow (Edwards 2005). Water quality in the Big Bend reach appears to be generally improving over time and we do not believe it is a primary determinant of the survivability of the Rio Grande silvery minnow in this reach (Edwards 2005). In addition, most of the Rio Grande in the Big Bend Reach on both sides of the river is designated as a conservation area and managed for habitat protection and improvement by the State of Texas, the National Park Service, and governmental agencies and private organizations in Mexico (Edwards 2005, p. 11).

The Service administers the ESA and is the principal Federal agency responsible for conserving, protecting and enhancing fish, wildlife and plants and their habitats for the continuing benefit of the American people. However, numerous individuals, agencies, and affected parties were involved in the development of the Recovery Plan or otherwise provided assistance and review. On July 8, 1999, we finalized the first Recovery Plan, pursuant to section 4(f) of the ESA. The Recovery Plan has been updated and revised and a draft revised Recovery Plan (Service 2007) was released for public comment on January 18, 2007 (72 FR 2301). The draft revised Recovery Plan recommends recovery goals for the Rio Grande silvery minnow, as well as research to better understand the biology of the species. The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are:

1. Prevent the extinction of the Rio Grande silvery minnow in the middle Rio Grande of New Mexico.
2. Recover the Rio Grande silvery minnow to an extent sufficient to change its status on the List

of Endangered and Threatened Wildlife from endangered to threatened (downlisting).

3. Recover the Rio Grande silvery minnow to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Downlisting (Goal 2) for the Rio Grande silvery minnow may be considered when three populations (including at least two that are self-sustaining) of the species have been established within the historic range of the species and have been maintained for at least five years.

Delisting (Goal 3) of the species may be considered when three self-sustaining populations have been established within the historic range of the species and they have been maintained for at least ten years (Service 2007).

1.2 Purpose of the Action

The purpose of the proposed action is to reestablish a self-sustaining population of the endangered Rio Grande silvery minnow in potentially suitable habitat found within the species' historic range in the Rio Grande in the Big Bend area of Texas.

The draft revised Recovery Plan defines a self-sustaining population as one that can sustain a minimum of 500,000 fish, for five consecutive years without augmentation from captive-bred fish (Service 2007).

1.3 Need for the Action

The Rio Grande silvery minnow currently inhabits approximately five percent of its historic range and only exists in the Middle Rio Grande in New Mexico. One of the primary goals of the

draft revised Recovery Plan is to ensure eventual recovery and delisting of the RGSM by reestablishing the Rio Grande silvery minnow in at least three areas of its historic range. The Service and the draft revised Recovery Plan have identified the Big Bend reach of the Rio Grande as part of the species' historic range most likely to support an additional population and as the first priority for reestablishment efforts.

In the final rule and EIS designating critical habitat for the Rio Grande silvery minnow, the Fish and Wildlife Service determined that the Rio Grande in the Big Bend area is important for the conservation of the species, but that our conservation strategy for the species would be to establish an experimental population in this area under section 10(j) of the ESA instead of designating critical habitat.

The proposed action is needed to produce a self-sustaining population of Rio Grande silvery minnow, under section 10(j) of the ESA, which will decrease the risk of extinction of the species due to environmental catastrophe, disease, or other unforeseen events and contribute to conservation and recovery of the species.

1.4 Scoping and Public Participation

The Service solicited public input for this Draft Environmental Assessment through written comments and public meetings held: September 20, 2005, in Sanderson, Texas; September 21, 2005, in Alpine, Texas; and, September 22, 2005, in Presidio, Texas.

1.4.1 Consultation and Coordination

In 2003, at the onset of the NEPA process for this proposal, the National Park Service and the U.S. Section of the International Boundary and Water Commission agreed to be cooperating agencies, as defined by NEPA. In January 2004, the Service met with numerous Texas agencies and officials. The Service provided information on the potential reestablishment of the Rio Grande silvery minnow as a NEP in the Big Bend reach. This meeting provided an opportunity for participants to ask questions about 10(j) and why the Service chose this area for possible reestablishment. The State agencies that participated in the information exchange made suggestions for facilitating effective and comprehensive public participation in the process.

The Service convened a NEPA Interdisciplinary Team to assist us in the planning and public participation required by NEPA for this proposal. The Interdisciplinary Team includes representatives from Big Bend National Park, Far West Texas Water Planning Group, Texas Commission on Environmental Quality, Texas Department of Agriculture, Texas Farm Bureau, Texas Parks and Wildlife Department, Texas Water Development Board, U.S. Section of the International Boundary and Water Commission, University of Texas-Pan American, and the World Wildlife Fund. The Interdisciplinary Team assisted the Service in considering the potential scope of our proposal and in preparing for the NEPA scoping process. After the NEPA scoping meetings, the Service convened the Interdisciplinary Team, which assisted us in considering the best scientific and commercial data available, as well as, the comments received from the scoping meetings in developing the alternatives considered in this Draft Environmental Assessment.

The Service is also working closely with natural resource and other agencies in Mexico regarding our proposal to reestablish the Rio Grande silvery minnow in the Big Bend reach. These agencies include the Mexican Section of the International Boundary and Water Commission, the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT), and the Comisión Nacional de Áreas Naturales Protegidas (CONANP). The entire Big Bend reach is also the border between the U.S. and Mexico, thus coordination with these Mexican agencies is crucial to the success of this project. The Rio Grande silvery minnow (also known as the Chamizal minnow) is listed in the Mexican Official Standard under category E, indicating that it is probably extinct in wild habitat (in Mexico) and is not endemic.

1.4.2. Issues and Concerns

The Service and Interdisciplinary Team identified issues and concerns associated with Rio Grande silvery minnow reestablishment through the NEPA scoping period. The alternatives have also been discussed with potentially affected State agencies. All comments from the three scoping meetings and public comment period have been analyzed and considered in developing the alternatives presented in this Draft Environmental Assessment.

The following is a summary of comments received in the form of e-mails, letters, and verbally at the public meetings:

- Ensure there are no impacts to water users or private property owners.
- Work with Mexico to obtain support and maintain flows.
- Remove non-native species, such as salt cedar.

- Adopt regulatory provisions guaranteeing that the operation of the Rio Grande Project will not be modified and U.S. Bureau of Reclamation contractual obligations to supply water from the Rio Grande Project will not be impacted to make water available for the minnow.
- Legal protection of Rio Grande Project water supplies is essential.
- Fort Quitman to Candelaria is not suitable because it cannot be hydrologically maintained. If the Service sought a reliable source of flowing water through this reach the only source would be Rio Grande Project water which belongs to the constituents of the Elephant Butte Irrigation District and El Paso County Water Improvement District.
- The NEP should be declared permanently and solely as a NEP. There should never be the possibility of converting it to an essential population or reclassifying it to provide additional section 9 protections.
- Any artificial reintroduction of minnow in this area should be done only after a legislative restriction upon that NEP's classification. To accomplish this, the Service should provide its own protections to nearby land and water rights owners by appropriate written, regulatory assurances/protections/prohibitions.
- What if the minnow does well and extends its range upward to Little Box Canyon and other areas such as into the Pecos River in Texas?
- What is the likelihood of the Service converting this NEP to one which is essential to the survival of the species? If it's not the Service's intention to make this conversion, how does the Service believe that continuing a Big Bend NEP contributes to recovery?
- The designation of a NEP is insufficient for the recovery of this species in Texas. The best chance for success lies with the proven strategy of designation of critical habitat.

- The FWS must research flow needs for the Rio Grande silvery minnow and when, where, and how to assure enough flow to perpetuate the fish in its habitat.
- There is nothing nonessential about the need to establish an additional population of Rio Grande silvery minnow outside the middle Rio Grande in New Mexico.
- We suggest the Service establish a time limit or sunset provision for the experimental status should the agency choose a 10(j) designation. After the expiration of the time limit, Rio Grande silvery minnow should receive full protection under the ESA.
- The erosion of the section 7(a)(2) consultation tool to a mere conferencing standard is unacceptable, particularly given the significant, though not extensive Federal water management actions that would affect this habitat.
- Consider the use of an essential population as one of the alternatives in the Draft Environmental Assessment.

2.0 Alternatives

2.1 Alternative A, Proposed Action: Designate a NEP for Rio Grande silvery minnow in portions of the Rio Grande and Pecos River in the Big Bend region. Reestablish Rio Grande silvery minnow in suitable habitat within this area.

2.1.1 Geographic scope of the proposed action.

The geographic boundaries of the NEP would extend, on the Rio Grande, from Little Box Canyon downstream of Ft. Quitman, Hudspeth County, Texas, through Big Bend National Park and the Rio Grande Wild and Scenic River, to Amistad Dam and the nearby railroad bridge and,

on the Pecos River, from its confluence with Independence Creek to its confluence with the Rio Grande. More information about the geographic scope of the proposed action can be found in section 2.1.9.

2.1.2 Selection and location of Rio Grande silvery minnow release sites.

The scope of this proposed action covers all Rio Grande silvery minnow releases in the NEP.

Release sites will initially be located in Big Bend National Park and potentially Texas Parks and Wildlife Department lands. Releases on privately owned lands would occur only if landowners are agreeable and the river sites represent potentially suitable habitat. Primary considerations for identifying Rio Grande silvery minnow release sites include:

1. Within or in proximity to potentially suitable habitat.
2. The extent of potentially suitable habitat surrounding a potential release site and its proximity to other similar habitats.
3. Access for logistical support.
4. Willing landowner or manager.

To ensure needed habitat elements exist, we recommend control of salt cedar and giant river cane (also known as giant reed) in the floodplain of the NEP area and upstream of this area (see *Appendix A* for a list of scientific names). The presence and abundance of these plant species have stabilized banks and sediments, caused scouring of sand and silt substrates from the river and reduced channel braiding, thus effectively reducing the amount of Rio Grande silvery minnow habitat (Edwards 2005). We anticipate working with land managers and other interested parties, on a voluntary basis, to develop plans to further guide habitat management. More

detailed information can be found in the Reestablishment of the Rio Grande Silvery Minnow to the Big Bend Reach of the Rio Grande: Implementation and Monitoring Plan (Implementation and Monitoring Plan) (*Appendix B*).

2.1.3 Rio Grande silvery minnow release techniques

Release methodology will be based on lessons learned from the successful Rio Grande silvery minnow propagation and augmentation programs in New Mexico. In 2000, the Service identified captive propagation as an appropriate strategy to assist in the recovery of the Rio Grande silvery minnow. On-going recovery efforts involving the release of captive-bred Rio Grande silvery minnow for augmentation of the population in the Rio Grande near Albuquerque, New Mexico have demonstrated the potential viability of reestablishment as a tool for Rio Grande silvery minnow conservation. Consistent with Service policy (65 FR 183), captive propagation is conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctiveness of the Rio Grande silvery minnow and minimize risks to existing wild populations.

Since 2000, more than 600,000 Rio Grande silvery minnow have been propagated, using both adult wild Rio Grande silvery minnow and wild caught eggs, and then released into the wild. While hatcheries successfully spawn Rio Grande silvery minnow, wild eggs are collected to ensure genetic diversity within the remaining population (Remshardt 2006).

Direct and indirect evidence from the Rio Grande silvery minnow monitoring program indicates that augmentation efforts in the Rio Grande near Albuquerque, New Mexico, are contributing to

an increase in catch rates of Rio Grande silvery minnow. The success of this augmentation effort indicates that hatchery raised individuals can be released back to the wild with adequate retention in or near original release sites, can experience survival of at least 2 years after release, and ultimately can contribute to future spawning efforts (Remshardt 2006).

As part of the augmentation program, the Service evaluated different release strategies such as time of year, time of day, specific release habitats, and various hatchery environments (natural outdoor ponds versus indoor facilities). All this information will add to the knowledge needed for future conservation while providing active management strategies for the Rio Grande in New Mexico and reestablishment in the Big Bend reach (Remshardt 2006).

2.1.4 Timing and duration of reestablishment activities

In order to meet the Purpose and Need of the proposed action, we anticipate releasing Rio Grande silvery minnow into the Big Bend reach at least once per year until either: (1) an evaluation of the program shows the Needs of the Action (Section 1.3) have been met, or (2) the establishment of Rio Grande silvery minnow in potentially suitable habitat becomes highly unlikely.

2.1.5 Monitoring

It is important for the monitoring program to be able to build on existing data and to be able to use statistically valid methods to assess changes in age-class structure and abundance of Rio Grande silvery minnow and other fish. After the initial stocking of this fish, we will monitor their presence or absence at least annually and document any spawning behavior or young-of-year fish that might be present. Monitoring may occur more frequently, especially during the

initial few years of reestablishment efforts. This monitoring will be conducted primarily by seining and will be accomplished by Service, Big Bend National Park, or State employees or by contracting with the appropriate species experts. Annual reports will be produced detailing stocking and monitoring activities that took place during the previous year. The Service, and cooperators of the reestablishment program, will also evaluate the program at least every five years. The evaluation will include an analysis of release protocols to determine whether modifications may be necessary to increase the likelihood of success, and an assessment of incremental progress in meeting objectives. More information about monitoring is included in the Implementation and Monitoring Plan (*Appendix B*).

2.1.6 Experimental Population

Under the ESA, species listed as endangered or threatened are afforded protection primarily through the prohibitions of the ESA outlined in section 9 and the requirements of section 7. Section 9 of the ESA prohibits the take of endangered wildlife species. “Take” is defined by the ESA as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. These section 9 prohibitions apply to any person subject to the jurisdiction of the United States. Section 7 of the ESA outlines the procedures for Federal interagency cooperation to conserve federally listed species. Section 7(a)(1) mandates all Federal agencies utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Section 7(a)(2) states that Federal agencies shall, in consultation with the Service, insure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. Section

7(a)(2) of the ESA does not affect activities undertaken on private lands unless those activities are authorized, funded, or carried out by a Federal agency.

Congress made significant changes to the ESA with the addition of section 10(j) in 1982, which provides for the designation of specific reestablished populations of listed species as “experimental” populations. The Service has always had the authority to reestablish populations in unoccupied portions of a listed species' historic range when doing so would foster the recovery of the species. However, local citizens often opposed these reestablishments because they were concerned about possible restrictions and prohibitions on Federal and private activities. Under section 10(j), the Secretary of the Interior can designate reintroduced populations established outside the species' current range, but within its historic range, as “experimental.” Designating a population as experimental under section 10(j) provides for increased management flexibility under the ESA. On the basis of the best available information, we must determine whether an experimental population is “essential” or “nonessential” to the continued existence of the species. With the experimental population designation, the relevant population is treated as threatened for purposes of section 9 of the ESA, regardless of the species' designation elsewhere in its range. Threatened designation allows us greater regulatory flexibility in managing the species. Within a NEP designated area, for the purposes of section 7 of the ESA, Rio Grande silvery minnow would be treated as proposed for listing outside of areas administered by the National Park Service [Big Bend National Park and the Rio Grande Wild and Scenic River] and as threatened within it (see section 2.1.7).

2.1.7 Nonessential experimental population

We have determined that the Big Bend reach of the Rio Grande is essential to the conservation of the Rio Grande silvery minnow (Service 2003). The definition of conservation in the ESA is the use of “all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary.” Thus, to conserve a species is to bring it to a level of recovery, at which point it may be delisted. Although, if successful, a population of Rio Grande silvery minnow in the Big Bend reach of the Rio Grande would be an essential factor in the *recovery* of the species, we have determined that this experimental population would not be essential to the *continued existence of the species in the wild*. Therefore, the Service is proposing to designate a NEP for the species in this area. This determination has been made for the following reasons:

- (a) an established population of Rio Grande silvery minnow exists in the middle Rio Grande, New Mexico;
- (b) captive propagation facilities maintain a captive population and provide adequate numbers of Rio Grande silvery minnow to maintain the wild New Mexico population at current levels;
- (c) the additional number of silvery minnow needed for reestablishment would not inhibit the augmentation efforts to maintain the established population in the middle Rio Grande, New Mexico; and
- (d) the possible failure of this proposed action would not appreciably reduce the likelihood of survival of the species in the wild.

We will ensure, through our section 10 permitting authority and the section 7 consultation process, that the use of Rio Grande silvery minnow from any donor population for releases in the Big Bend reach is not likely to jeopardize the continued existence of the species in the wild.

For the purposes of section 7 of the ESA, under a NEP designation, Rio Grande silvery minnow occurring in the Rio Grande in Big Bend National Park or the Rio Grande Wild and Scenic River, which is administered by the National Park Service, would be treated as threatened.

Therefore section 7(a)(1) and the consultation requirements of section 7(a)(2) of the ESA would both apply. Outside the National Park system, which includes Big Bend National Park and Rio Grande Wild and Scenic River, silvery minnow would be treated as a species proposed for listing for purposes of section 7(a)(2), and Federal agencies would be required to conference with the Service only on actions that are likely to jeopardize the continued existence of the Rio Grande silvery minnow. Section 7(a)(1), which requires Federal agencies to use their authorities to conserve endangered and threatened species, still applies to all Federal agencies.

Section 10(j) is designed to increase our management flexibility. The regulatory restrictions of sections 7 and 9 of the ESA are considerably reduced under a NEP designation for a listed species and are usually more compatible with routine human activities in the establishment area. In situations where we have experimental populations, certain section 9 prohibitions would no longer apply and special rules may be written under section 4(d) of the ESA. The special rules written for this proposed action include defining allowable take of Rio Grande silvery minnow (see section 2.1.8).

The NEP designation for the reestablishment alleviates landowner and water user concerns about possible land and water use restrictions by providing a flexible management framework for protecting and recovering Rio Grande silvery minnow, while ensuring that the daily activities of landowners are unaffected. Landowners and managers are more likely to accept Rio Grande silvery minnow in the Rio Grande adjacent to their lands with the flexibility provided by a NEP designation, which allows us to build better partnerships and explore potential habitat improvement projects with a larger group of landowners.

While it is true that consultation requirements would be lessened under this alternative, we believe that incidental take associated with otherwise lawful activities would not pose a long-term threat to Rio Grande silvery minnow recovery, as activities that currently occur in the NEP area would be compatible with Rio Grande silvery minnow recovery. Thus, the more stringent legal protections provided under an essential experimental population are unnecessary.

Section 10(j) of the ESA requires that an experimental population be geographically separate from other wild populations of the same species. This NEP area is totally isolated from existing populations of this species by large reservoirs in New Mexico, and the best available information indicates this fish does not survive in large reservoirs because there are many predators and no suitable habitat for Rio Grande silvery minnow. These reservoirs will ensure that this NEP remains geographically isolated and easily distinguishable from existing upstream wild populations in New Mexico. In addition, Amistad Reservoir will act as a barrier to the species' downstream movement in the Rio Grande

2.1.8 Allowable take

The ESA defines "incidental take" as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity such as recreation (e.g., fishing, boating, wading, trapping or swimming), forestry, agriculture, and other activities that are in accordance with Federal, Tribal, State, and local laws and regulations. Under this proposed action, and the associated special rules, a person may take a Rio Grande silvery minnow within the experimental population area so long as the take is unintentional and was a result of an otherwise legal activity. Such conduct will not constitute "knowing take," and will be allowed under provisions of the 4(d) regulations. We expect levels of incidental take to be low because activities that currently occur in the NEP area are compatible with Rio Grande silvery minnow recovery. For example, there are no major dams or diversions in the Big Bend reach, which are the primary threats to the species within its current range in the Rio Grande in New Mexico. Also, most of the portion of the Big Bend reach in which we expect Rio Grande silvery minnow to become established is protected and managed for fish and wildlife and other natural resources by State and Federal agencies in both the United States and Mexico.

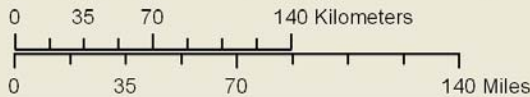
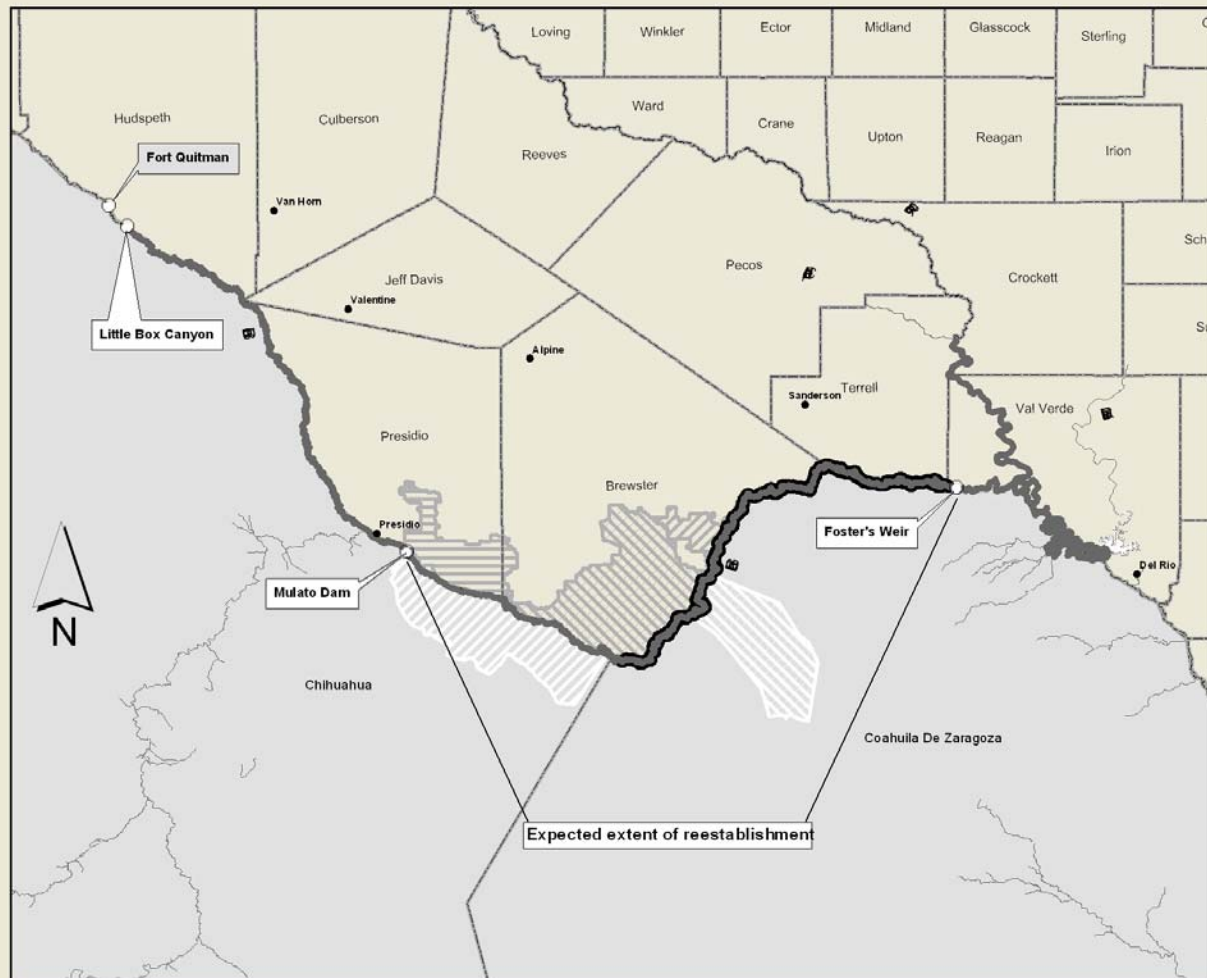
2.1.9 Geographic boundaries for the proposed NEP

Based on the presence of suitable habitat, the presence of similar fish species that have similar habitat requirements to the Rio Grande silvery minnow, the recommendations of the Rio Grande Silvery Minnow Recovery Team, and the results of a feasibility study (Edwards 2005), the area in which Rio Grande silvery minnow are most likely to become reestablished after potential reintroduction is the Rio Grande from Mulato Dam near Presidio, Texas to Foster's Weir near

the Terrell/Val Verde County line. However, the geographic extent being considered for designation is larger and includes the Rio Grande from Little Box Canyon downstream of Ft. Quitman, Hudspeth County, Texas, through Big Bend National Park and the Rio Grande Wild and Scenic River, to Amistad Dam and the nearby railroad bridge, Amistad Reservoir and the Pecos River from its confluence with Independence Creek to its confluence with the Rio Grande. Although only the portions of this area described above contain suitable habitat, this area represents what we believe to be the maximum geographic extent to which the fish could move if released in the Big Bend reach of the Rio Grande. We are proposing designation of a nonessential experimental population of Rio Grande silvery minnow for the maximum extent that fish might move from release sites to minimize regulatory burdens and restrictions for landowners and water users in areas adjacent to the expected establishment area. We believe including this additional area provides a more effective recovery strategy by providing regulatory certainty to land owners, water users, and public agencies outside of the expected extent of establishment in the Big Bend reach of the Rio Grande.

Based on the habitat requirements of the Rio Grande silvery minnow, we do not expect them to become established outside the NEP. However, if any of the released Rio Grande silvery minnow move outside the designated NEP area, then the Service will consider these fish to have come from the NEP area. In that case, we will propose to amend the rule and enlarge the boundaries of the NEP area to include the entire range of the expanded populations.

Proposed 10(j) Experimental Population area for Rio Grande silvery minnow



Description	
	Potential 10(j) Experimental Population area for Rio Grande silvery minnow
	Black Gap Wildlife Management Area
	Big Bend Ranch State Park
	Rio Grande Wild & Scenic River
	Big Bend National Park
	Canon de Santa Elena
	Maderas del Carmen



DISCLAIMER

This map is a graphical representation of the Potential 10(j) Experimental Population area for Rio Grande silvery minnow and is provided for illustrative purposes only. The map and [GIS (vector and/or raster)] files used to create this map are not the definitive source for determining these area boundaries. While the Service makes every effort to represent the area shown on this map as completely and accurately as possible (given existing time, resource, data and display constraints), the USFWS gives no warranty, expressed or implied, as to the accuracy, reliability, or completeness of these data.

Figure 1. Action Area.

2.2 Alternative B, No Action: Do not designate a NEP for Rio Grande silvery minnow in portions of the Rio Grande and Pecos River in the Big Bend region and do not reestablish Rio Grande silvery minnow in this area.

The No Action Alternative would continue existing river management without release of Rio Grande silvery minnow. In this alternative, Rio Grande silvery minnow would not be reestablished in the Big Bend reach. The Service believes that movement of Rio Grande silvery minnow from the Rio Grande near Albuquerque, New Mexico to this reach is impossible due to the presence of long reaches of unsuitable habitat and large reservoirs. This alternative would allow for the option of designating critical habitat in this reach should future analysis prove that it is warranted.

2.3 Alternatives Considered But Eliminated from Detailed Study

2.3.1 NEP designation and reestablishment of Rio Grande silvery minnow, limited to Rio Grande only where adjacent to Big Bend National Park, Big Bend Ranch State Park, Black Gap Wildlife Management Area, and the Rio Grande Wild and Scenic River.

This reach of the Rio Grande encompasses the primary reach where we believe suitable habitat exists and Rio Grande silvery minnow are most likely to become established. This alternative would have limited the nonessential experimental population designation only to the reach with suitable habitat and left out of the designation additional reaches to which the fish could possibly move from the proposed release sites, but which do not contain suitable habitat. This alternative could have resulted in regulatory burdens and restrictions for landowners and water users in

areas adjacent to the expected establishment area because if the Rio Grande silvery minnow were to move beyond the reach of river designated as an experimental population, it would be fully protected as an endangered species under the ESA (see section 2.1.9 for further information).

2.3.2 Essential experimental population designation and reestablishment of Rio Grande silvery minnow.

This alternative was not selected for further analysis because the Service has determined that this experimental population would not be essential to the continued existence of the species for the reasons listed in section 2.1.7.

Furthermore, after careful analysis of the land and water use in the Big Bend reach of the Rio Grande, including the analysis performed for the designation of critical habitat for the Rio Grande silvery minnow, we have determined that there are no current or on-going activities with a Federal nexus that are likely to significantly adversely affect the Rio Grande silvery minnow in this area. Thus, the more stringent legal protection provided by the ESA under an essential population designation is not needed to protect reintroduced Rio Grande silvery minnow.

Landowners and managers are more likely to accept Rio Grande silvery minnow in the Rio Grande adjacent to their lands with the flexibility provided by a NEP designation, which allows us to build better partnerships and explore potential habitat improvement projects with a larger group of landowners. Our 10(j) regulations require that, to the extent practicable, a regulation issued under section 10(j) of the ESA represents an agreement between the Service, the affected State and Federal agencies, and persons holding any interest in land that may be affected by the establishment of the experimental population. Affected State agencies, landowners, and land

managers have indicated support for the proposed reestablishment, provided a NEP is designated and land and water use activities in the proposed NEP area are not constrained.

Table 1. Alternatives presented with regard to meeting the Purpose and Need of the action.

Alternatives	A (Proposed Action)	B (No Action)
<p>Purpose and Need: Reestablish a viable Rio Grande silvery minnow population in the Big Bend reach of the Rio Grande.</p>	<p>Meets Purpose and Need if potential habitat is suitable and reestablishment is successful.</p>	<p>Does not meet Purpose and Need because reestablishment is not possible without human assistance.</p>

3.0 Affected Environment

The affected environment consists of biophysical components, social and economic components, and cultural components of the Big Bend region that may be affected by the proposed action.

There are two geographic areas addressed in this document: the total NEP area, and the expected establishment area for released Rio Grande silvery minnow (see Figure 1). We believe there is very low probability that Rio Grande silvery minnow will move outside the expected establishment area on the Rio Grande from Mulato Dam to Foster’s Weir because they are unlikely to find suitable habitat either upstream or downstream from this area. However, the affected environment and impact analysis include the larger area being proposed for designation as a NEP area (see section 2.1.9 for more information about the action area).

Land in the U.S. along the Rio Grande within the expected establishment area is managed by the State of Texas, National Park Service, U.S. Section of the International Boundary and Water Commission, CEMEX, and other private landowners. CEMEX is an international cement company which owns land set aside for natural resources protection in both the U.S. and Mexico along the Big Bend reach. Information in addition to that found in this document on the Big Bend reach and region can be found in the Designation of Critical Habitat for Rio Grande Silvery Minnow; Final Environmental Impact Statement (Service 2003).

Along the portions of the Rio Grande and Pecos River that comprise the action area, there may be effects to the following elements of the environment:

3.1 Biophysical

3.1.1 Floodplains, Wetlands, Riparian Zones, and Native and Non-Native Vegetation

The riparian zone in the Big Bend reach once included lance-leaf cottonwoods and willows. Forests were probably not extensive, as riparian vegetation was often cleared by scouring floods. Prior to the establishment of Big Bend National Park most of the larger floodplain areas were cleared for farming and grazing, and native cottonwoods were nearly eliminated by woodcutters. These activities, along with changes to the flow characteristics of the river (high and low water timing, duration, and intensity) and invasion of exotic species, have greatly altered the character of the riparian zone. Additionally, with changes in flooding frequency and dynamics, the Big Bend reach has changed from a channel with erodible banks that migrates across the floodplain to one with stabilized banks and an incised channel (Bennet 2006).

Native trees such as huisache and willow are still common near the river in some areas, but much of the river floodplain is now dominated by nonnative species. Bermuda grass is widespread on many sections of riverbank. Throughout the river corridor, extensive stands of introduced giant river cane, along with native common reed, line the shore. Non-native salt cedar occupies extensive areas, out-competing native species for water and nutrients. In drier areas of the floodplain, particularly in the Rio Grande Wild and Scenic River segment, characteristic Chihuahuan Desert species such as mesquite, saltbush, and creosote bush continue to dominate (see *Appendix A* for a list of scientific names).

3.1.1.1 Federally-listed (threatened and endangered) plant species

Two federally threatened species of cactus, bunched cory cactus and Chisos Mountain hedgehog cactus, are present in Big Bend National Park and on lands adjacent to the Rio Grande Wild and Scenic River. Both species occur primarily in upland areas, but may be found within the river corridor in a few locations (National Park Service 1997) (see *Appendix A* for a list of scientific names).

3.1.2 Fish and Wildlife

Fish and wildlife resources potentially affected by the proposed action include the Rio Grande silvery minnow and those animals that are potential predators and/or competitors.

3.1.2.1 Rio Grande silvery minnow

Seven collections made between 1938 and 1960 document that the Rio Grande silvery minnow was among the most common fishes of the Big Bend reach. The species has not been found in this reach since 1960, despite frequent fish samplings from 1977 to the present. There are no records of the Rio Grande silvery minnow in the Rio Conchos in either historic or recent collections (Service 2007).

3.1.2.2 Fish communities of the lower Big Bend reach.

The portion of the Rio Grande between Presidio and Amistad Reservoir contains a somewhat different and more diverse fish fauna than upstream or downstream reaches. Forty-six known species of fish have been recorded in the Big Bend reach, including eight species that are now extirpated or extinct. Thirty-four are native, and 12 have been introduced (National Park Service 1997). This reach is characterized by at least two major categories of fishes: large-bodied, long-lived, big-river fishes and small-bodied, short-lived fishes. Examples of the former include the longnose gar, gizzard shad, river carpsucker, blue sucker, smallmouth buffalo, and common carp. Several species of gamefish, including blue catfish and flathead catfish are present and caught by anglers in Big Bend National Park. The majority of the native fish in the Big Bend reach are of minnow size. At least 12 species of minnow, 10 of which are native, occur in this reach of the Rio Grande. Two of these species (speckled chub and Rio Grande shiner), like the Rio Grande silvery minnow, are pelagic spawners, producing semi-buoyant eggs that drift downstream. Both are widespread throughout the reach. Other common members of the fish fauna in the Big Bend reach include the red shiner, Tamaulipas shiner, Mexican tetra, and western mosquito fish (Service 2003) (see *Appendix A* for a list of scientific names).

3.1.2.3 Federally-listed (threatened and endangered) fish and wildlife species.

The Rio Grande in this reach presently contains no federally-listed threatened or endangered species. One candidate species for Federal listing, the Texas hornshell (a freshwater mussel), is possibly present in this reach. Dead shells have been found, confirming the recent presence of the species (Renfrow 2005). This species was formerly widespread in the Rio Grande and Pecos River drainage basins; the only confirmed extant population today exists in the Black River in New Mexico (see *Appendix A* for a list of scientific names).

One federally endangered fish species, the Big Bend gambusia, occupies shallow, spring-fed natural pools near Rio Grande Village in Big Bend National Park. When discovered, the species occupied a single spring near Boquillas Crossing. Individuals were introduced into three spring-fed pools near the river corridor, where the species currently persists. This species remains threatened due to the greatly restricted area of its habitat. The gambusia is vulnerable to the introduction of other minnow species to the isolated pools in which it occurs (Service 1984) (see *Appendix A* for a list of scientific names).

There are no records of the southwestern willow flycatcher in Big Bend National Park, although its presence at the extreme eastern edge of its geographic range is a possibility. The bald eagle is a federally threatened species (currently proposed for delisting) that occasionally uses Big Bend National Park during migration. This species is a rare visitor to the river floodplain during spring and fall. The peregrine falcon, which nests in canyons above the river corridor along the Big Bend reach, was de-listed in 1999. Other federally listed wildlife species present within Big Bend National Park, but largely outside of the river corridor, are the black-capped vireo (Troy

2006) and the Mexican long-nosed bat (England et al. 2004) (see *Appendix A* for a list of scientific names).

3.1.2.4 State-listed and conservation target species.

The Mexican stoneroller, Chihuahua shiner, proserpine shiner, Conchos pupfish and blue sucker are all listed as threatened in the state of Texas. In addition, the Big Bend reach includes a number of freshwater fish species listed as conservation target species (Service 2006), including the mexican tetra, smallmouth buffalo, west mexican redhorse, gray redhorse, longnose dace, speckled chub, Rio Grande shiner, roundnose minnow, tamaulipas shiner, and blue catfish. (see *Appendix A* for a list of scientific names).

3.1.2.5 Other wildlife.

The river corridor in the Big Bend reach is used extensively by a large number of wildlife species. A number of medium-sized mammals including gray fox, raccoon, and striped skunk inhabit the riparian zone. Several broad-ranging mammals, including black bear and mountain lion occasionally use the river corridor in Big Bend National Park. Mexican beaver, a Mexican endangered species, occupies areas along the Rio Grande throughout the Big Bend reach. Nutria, a non-native mammal, have invaded the river corridor and caused degradation of aquatic habitat in some areas by consuming aquatic vegetation (Milholland 2005) (see *Appendix A* for a list of scientific names).

More bird species have been recorded at Big Bend than any other National Park. Many resident and migrant species make use of the riparian vegetation along the river corridor. Common

nesters in riparian habitat include the mourning dove, Western yellow-billed cuckoo, black-chinned hummingbird, ladder-backed woodpecker, Bell's vireo, common yellowthroat, yellow-breasted chat, orchard oriole, summer tanager, Northern cardinal, blue grosbeak, and painted bunting. Somewhat less common are white-winged and common ground doves, western screech-owl, elf owl, vermilion flycatcher, and hooded oriole (Wauer 1985) (see *Appendix A* for a list of scientific names).

The most common amphibians along the river are Rio Grande leopard frog and red-spotted toad. Three native species of turtle reside in the river corridor: Big Bend slider, yellow mud turtle, and spiny softshell. The non-native elegant slider is also present, and may be threatening the Big Bend slider by hybridization. Lizard species present in the floodplain include the Texas banded gecko, southwestern earless lizard, desert spiny lizard, canyon lizard, side-blotched lizard, and marbled whiptail. Common snakes include the coachwhip, spotted night snake, and western diamondback rattlesnake. Less common to rare are the trans-Pecos blind snake, glossy snake, Great Plains rat snake, desert kingsnake, blotched water snake, checkered garter snake, and Big Bend patch-nosed snake (Big Bend Natural History Association 2002) (see *Appendix A* for a list of scientific names).

3.1.3 Water Quality

Over the last 20 years extensive development and population growth has occurred in the United States-Mexico border region, particularly in the El Paso/Juarez metropolitan area, some 483 kilometers (300 miles) upstream from Big Bend National Park. This growth, fueled in part by more than 1400 maquiladora (product assembly) plants on the Mexican side of the border, has

resulted in increased potential for water quality degradation and toxic chemical contamination. Heightened public and government attention was focused on these issues in 1993 when American Rivers, the principal river conservation organization in the United States, listed the Rio Grande/Rio Conchos as the most endangered river system in America. Sources of contaminants in the area immediately upstream from Big Bend National Park include untreated sewage from Ojinaga, Chihuahua, Mexico and smaller border villages, livestock grazing in riparian areas, agricultural runoff, and mining activities including past underground mining for mercury near Terlingua just outside of Big Bend National Park boundaries. However, the largest potential sources of toxic contaminants in the Big Bend reach are further upstream. Point and nonpoint sources include agricultural runoff from farming operations around El Paso/Ciudad Juarez and in the upstream watershed of the Rio Conchos; drainage from past and current mining activities in Mexico and the United States; and both treated and untreated municipal and industrial wastewater from El Paso/Juarez. Elevated fecal coliform levels, as well as heavy metals and pesticides, have been identified in several segments of the Rio Grande in Texas, particularly downstream from border cities. As noted previously, water quality generally improves downstream from Big Bend National Park on the Rio Grande Wild and Scenic River, due to the presence of springs, which help to maintain higher flows and provide greater dilution of salts and other pollutants. More information on the water quality in the Big Bend reach can be found in the Designation of Critical Habitat for Rio Grande Silvery Minnow; Final Environmental Impact Statement (Service 2003).

3.2 Social and Economic

3.2.1 Land and Water Use

Land uses within the action area are agriculture, grazing, ranching, recreation, and conservation.

Big Bend National Park occupies roughly 323,750 hectares (800,000 acres), or 25 percent of the total land area in Brewster County. Lands within Big Bend National Park are owned by the United States, and used primarily for recreational and conservation purposes. Grazing is not allowed in Big Bend National Park, but is legally allowed on private ranches adjacent to the Rio Grande Wild and Scenic River downstream of Big Bend National Park boundaries. Grazing of trespass livestock from Mexico occurs frequently in Big Bend National Park. The U.S. Department of Agriculture, in cooperation with the National Park Service, conducts periodic trespass livestock round-ups.

Surrounding lands are used for a variety of purposes, primarily recreation, ranching, and agriculture. To the northwest, Big Bend Ranch State Park occupies over 113,312 hectares (280,000 acres) along the Rio Grande from southeast of Presidio to near Lajitas. The State Park offers camping, lodging, and a variety of recreational activities for visitors. To the east, the Black Gap Wildlife Management Area borders Big Bend National Park, encompassing 40,469 hectares (100,000 acres) including a 48-mile (30-mile) reach of the Rio Grande Wild and Scenic River. This remote area is undeveloped and receives relatively few visitors. The mountain region to the north of Big Bend National Park also provides recreational opportunities and attracts tourists to Alpine, the largest town in Brewster County with a population of roughly

6,000. In Presidio County, small-scale agriculture occurs along the Rio Grande; however, very little irrigated agriculture occurs within the Big Bend reach overall (Service 2003). Elsewhere throughout Presidio, Brewster, and Terrell counties, as across the border in Mexico, grazing remains the predominant land use (Service 2003).

Aside from Black Gap Wildlife Management Area, lands downstream from Big Bend National Park are owned by 12-15 private landowners. Most are very large holdings and are minimally grazed. Several former ranches have been subdivided into smaller acreages with numerous owners. Although some cattle are present on private lands along the Rio Grande Wild and Scenic River, the remoteness and ruggedness of the region make active livestock management difficult or impossible along much of the river zone. Sheep and goat raising is more common in the lowest reaches of the Rio Grande Wild and Scenic River (National Park Service 2004).

Throughout the 1990s, the number of annual visitors to Big Bend National Park have ranged from 250,000 to 350,000, and record high visitation occurred in 2005, at over 400,000. The river zone is a primary recreational area for Big Bend National Park visitors. Users of the Rio Grande corridor include private and commercial recreational boaters, anglers, non-boating riverside campers, and day-use recreationists. Approximately three percent of Big Bend National Park visitors participate in either a commercial or private river trip. Commercial outfitters currently operate out of the gateway communities of Lajitas, Terlingua, and Study Butte. River trip options range from half-day trips through Santa Elena canyon to wilderness trips of many days extending through the Lower Canyons of the Rio Grande Wild and Scenic River. Those visitors

not taking a boat trip visit the river corridor for hiking, camping, and wildlife viewing opportunities (National Park Service 1997).

There is little recreational use of the Rio Grande Wild and Scenic River except for float trips originating primarily at La Linda, downstream of Big Bend National Park, and fishing parties boating from privately owned access points further downstream (National Park Service 2004). Visitors to this remote region enjoy the opportunities it offers for wilderness solitude, and nature and wildlife viewing. River traffic from recreational boaters in the Rio Grande Wild and Scenic River averages range from 1,100 to 1,500 visitors per year. Limits are placed on the size of groups and numbers of launches per day, according to the Recreational River Use Management Plan (National Park Service 1997).

Fishing is allowed in Big Bend National Park and the Rio Grande Wild and Scenic River. In Big Bend National Park, a free National Park Service fishing permit is required per party. From 1999 through 2006, an average of 137 fishing permits were issued annually. The vast majority of permittees fished near riverside development zones such as Rio Grande Village and Castolon. A minority fished at a few widely dispersed backcountry road access points and by boat. The only species commonly sought by fishing parties are catfish. In Big Bend National Park, use of rods, trot and throw lines is allowed. In order to prevent introduction of exotic fish and invertebrate species, use of live bait is not allowed in Big Bend National Park except for use of other fish caught locally in the river. This makes it possible to use traps or nets for capture of minnows with which to bait catfish hooks. Big Bend National Park staff report that extremely few fishing permittees in Big Bend National Park actually capture minnows for bait, preferring the convenience of purchasing non-living commercially available baits (Skiles 2006).

State fishing regulations apply for the Rio Grande Wild and Scenic River outside of Big Bend National Park. Again, catfish are the only common target species. In addition to fishing methods described above, use of free-floating plastic bottles with a short line attached, known as jug fishing, is also practiced. Bait restrictions are not in place in the Rio Grande Wild and Scenic River, thus use of commercially available live or non-living bait is most common, yet capture of bait minnows is not prohibited. Similar to within Big Bend National Park, there is virtually no use of locally captured bait minnows due to the greater convenience of purchased bait (Skiles 2006).

3.2.2 Water Rights and Use

U.S. water rights to Rio Grande water flowing below Ft. Quitman are allocated under the Treaty of February 3, 1944, for “Utilization of Waters of the Colorado and Tijuana Rivers and of the Rio Grande” (TS 994; 59 Stat 1219). Under the 1944 Treaty, the United States is allocated one-half of the flows occurring in the main channel of the Rio Grande downstream from Fort Quitman, and one-third of the flows reaching the main channel from six Mexican tributaries including the Rio Conchos. The Rio Conchos is by far the largest of the six tributaries. The treaty also provides that this third shall not be less, as an average amount over a five year cycle, than 350,000 ac-ft annually. This treaty also entrusts the U.S. Section of the International Boundary and Water Commission with the application of its terms.

Water rights on federally owned property in Big Bend National Park belong exclusively to the U.S. under Texas state law. Big Bend National Park holds state-administered rights to approximately 1,500 ac-ft of water per year, of which it typically uses around 600 ac-ft for

campground irrigation. From the mouth of the Conchos downstream to Big Bend National Park, a number of private parties own state administered water rights. Water diversions in the Presidio Valley are primarily for agriculture. A rapidly expanding resort development at Lajitas, just outside of Big Bend National Park boundaries, is placing increasing demand on river water. Extensive landscaping, new guest facilities, and a new 18-hole golf course have been constructed. Other private water uses are for stock and rural domestic use. From Big Bend National Park downstream to Amistad Reservoir, water diversions from the river are minimal (Service 2003).

3.2.3 Demographics

The Big Bend region is one of the most sparsely populated regions of the country. The counties described below border the Rio Grande and/or the Pecos River within the proposed action area. Presidio, Brewster, and Terrell Counties border the Rio Grande along the reach where we expect the Rio Grande silvery minnow would become established after releases under the proposed action. Hudspeth, Jeff Davis, Val Verde, and Crockett Counties border the Rio Grande and/or the Pecos River along the reaches that are proposed to be included as part of the larger area designated as a NEP area, but are not within the area we expect Rio Grande silvery minnow would become established after releases.

Hudspeth County

Hudspeth County had a year 2005 population of 3,295. This total represents a decline in population of 1.5 percent from 2000. Population density in Hudspeth County was approximately 0.7 persons per square mile in 2000. In 2004, 75.9 percent of the population reported being of

Hispanic or Latino origin. Median household income in Hudspeth County is approximately \$21,855. Over twenty-eight percent of the population lives in poverty.

Hudspeth County is dominated by rangeland. Texas Parks and Wildlife Department manages about 11,000 acres in Hudspeth and Culberson Counties as part of the Sierra Diablo Wildlife Area. Business statistics indicate a total of 42 private non-farm establishments (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Jeff Davis County

Only a small fraction of a mile of the Rio Grande borders Jeff Davis County. Jeff Davis County had a year 2005 population of 2,306. This total represents a growth in population of 4.5 percent from 2000. Population density in Jeff Davis County was approximately 1.0 person per square mile in 2000. In 2004, 36.6 percent of the population reported being of Hispanic or Latino origin. Median household income in Jeff Davis County is approximately \$32,248. Nearly 15 percent of the population lives in poverty.

Valentine and Fort Davis are the only significant population centers in Jeff Davis County. Business statistics indicate a total of 56 private non-farm establishments (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Presidio County

Presidio County had a year 2005 population of 7,722. This total represents a growth in population of 5.7 percent from 2000. Population density in Presidio County was approximately

1.9 persons per square mile in 2000. In 2004, 84 percent of the population reported being of Hispanic or Latino origin. Median household income in Presidio County is approximately \$24,000. Nearly twenty-eight percent of the population lives in poverty.

Presidio County is dominated by rangeland. Presidio and Marfa, the county seat, are the only significant population centers. Business statistics indicate a total of 125 private non-farm establishments (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Brewster County

Brewster County had a year 2005 population of 9,079 people spread out over 6,200 square miles, resulting in a population density of 1.4 persons per square mile. Reports indicate forty-five percent of the population is of Hispanic or Latino origin. Median household income is approximately \$29,200. Nearly eighteen percent of the population lives in poverty.

Brewster County is a rural county dominated by private ranches and some 3 million acres of rangeland. The Nature Conservancy owns 67,129 acres in Brewster County in the Rosillos Mountains Preserve. No ranching or grazing activities occur in Big Bend National Park, the only part of the county potentially affected by designation of a NEP and reestablishment of Rio Grande silvery minnow. Business statistics indicate 297 private non-farm business establishments in 2003. Big Bend National Park is one of the largest employers in Brewster County. Big Bend National Park staffing in 2000 included 90 permanent and 45 seasonal National Park Service employees. The concessions company in Big Bend National Park

employed an additional 56 permanent and 15 seasonal workers (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Terrell County

Terrell County had a 2005 population of roughly 996. This total represents a decline of almost eight percent from 2000. Population density in Terrell County is 0.5 persons per square mile. Reports indicate nearly fifty-one percent of the population is of Hispanic or Latino origin. Median household income in Terrell County is approximately \$26,700 and the average earnings per job is approximately \$16,800. Eighteen percent of the population lives in poverty.

Terrell County is a sparsely settled area dominated almost entirely by rangeland. The population density is 180 times lower than that of the State of Texas as a whole. Sanderson, the county seat, is the only significant population center. Business statistics indicate a total of 18 private non-farm business establishments, all employing fewer than 20 people (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Val Verde County

Val Verde County had a year 2005 population of 47,596. This total represents a growth in population of 6.1 percent from 2000. Population density in Val Verde County was approximately 14.1 persons per square mile in 2000. In 2004, 78 percent of the population reported being of Hispanic or Latino origin. Median household income in Presidio County is approximately \$30,407. Twenty-two percent of the population lives in poverty. Business statistics indicate a total of 814 private non-farm establishments (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

Crockett County

Crockett County had a year 2005 population of 3,934. This total represents a decline in population of four percent from 2000. Population density in Crockett County was approximately 1.5 persons per square mile in 2000. In 2004, 55 percent of the population reported being of Hispanic or Latino origin. Median household income in Presidio County is approximately \$33,037. Over 15 percent of the population lives in poverty. Business statistics indicate a total of 122 private non-farm establishments (Statistics from www.fedstats.gov; Texas Water Development Board 2001; Brock et al. 2001).

3.3 Cultural

3.3.1 Indian Trust Resources

There are no issues regarding Federal Indian trust resources in the NEP area.

3.3.2 Environmental Justice

The social and economic data cited above for Presidio, Brewster, and Terrell counties—including low income levels, high rates of poverty, and significant Hispanic populations—indicate that the population in these counties may be susceptible to environmental justice concerns associated with impacts to local economies.

3.3.3 Cultural Resources

Although no complete survey has been done, archeologists estimate that Big Bend National Park may contain 26,000 archeological sites, with evidence and material remains of 10,000 years of

American Indian occupation. Two prehistoric archeological sites are presently considered public: the Hot Springs pictograph site and the Chimneys. There are eight National Historic Register sites or districts in Big Bend National Park. The Hot Springs Historical District lies largely within 91.4 meters (300 feet) of the river. The site consists of an old motel, store, and post office, all no longer in use. The Rio Grande Wild and Scenic River downstream of Big Bend National Park contains additional prehistoric and historic sites, mostly on private property. A thorough inventory of sites in the Big Bend reach is not currently available thus the exact number of prehistoric sites that may be present within the boundaries of the area proposed for designation as a NEP area is unknown (Mallouf and Tunnell 1977; National Park Service 2004).

4.0 Environmental Consequences

4.1 Alternative A, Proposed Action: Designate a NEP area for Rio Grande silvery minnow in Texas. Reestablish Rio Grande silvery minnow in suitable habitat in the NEP area.

4.1.1 Biophysical

4.1.1.1 Floodplains, Wetlands, Riparian Zones, and Native and Non-Native Vegetation

No direct impacts on floodplains, wetlands, riparian zones, and native or non-native vegetation are anticipated under this alternative. Aquatic habitat and vegetation within the flood plains in this reach may be improved as an indirect result of this alternative if actions are implemented

under section 7(a)(1), discretionary conservation measures, to improve habitat for the Rio Grande silvery minnow. By focusing management attention on the needs of the Rio Grande silvery minnow, this alternative would provide further justification for the allocation of Big Bend National Park and other resources towards removal of encroaching vegetation that has armored the banks, including invasive, non-native species, such as salt cedar and giant river cane, within the flood plains in this reach to improve habitat for the Rio Grande silvery minnow. Removal of salt cedar and giant river cane from areas where it has become dominant would also benefit native riparian vegetation. No adverse direct or indirect impacts to any threatened or endangered plant species are anticipated.

4.1.1.2 Fish and Wildlife

We expect that this alternative would result in the establishment of a self-sustaining Rio Grande silvery minnow population that would contribute to the recovery of this species. We will ensure, through our section 10 permitting authority and the section 7 consultation process, that the use of Rio Grande silvery minnow eggs, juveniles, or adults from any donor population for these releases is not likely to jeopardize the continued existence of the species.

Although under existing Big Bend National Park guidelines, anglers may use nets to capture minnows for use as bait, the number of anglers using nets to capture minnows is small. Their impact upon the Rio Grande silvery minnow is expected to be inconsequential (see pp. 36-37 for further details).

Due to the fact that Rio Grande silvery minnow were once a common species in the Big Bend reach, it is anticipated that their potential reestablishment will not significantly affect the current fish community in the Big Bend reach. If reestablishment is successful, some decrease in population density of other members of the minnow family (Cyprinidae) may occur due to similar habitat and food habits. However, this will be monitored over time along with Rio Grande silvery minnow monitoring. To the extent that designation of a NEP and reestablishment of Rio Grande silvery minnow would focus management attention on habitat preservation and improvement, it may benefit certain other species whose habitat overlaps that of the Rio Grande silvery minnow. This reach currently supports two members of the Rio Grande silvery minnow's reproductive guild (pelagic spawners), the speckled chub and Rio Grande shiner. This reach also includes other minnow species, which have been extirpated from upstream and downstream sections of the Rio Grande. All of these species would likely receive some benefit from this alternative if actions are implemented under section 7(a)(1), discretionary conservation measures. No adverse direct or indirect impacts to any threatened or endangered fish or wildlife species are anticipated.

4.1.1.3 Water Quality

No direct impacts on water quality are anticipated under this alternative. Water quality in this reach may be slightly improved as an indirect result of this alternative if actions are implemented under section 7(a)(1), discretionary conservation measures, to improve water quality for the Rio Grande silvery minnow. No adverse direct or indirect impacts to water quality are anticipated.

4.1.2 Social and Economic

4.1.2.1 Land Use

Grazing and agriculture are not legal activities within Big Bend National Park. Ranching and farming activities upstream of Big Bend National Park, and downstream on lands adjacent to the Rio Grande Wild and Scenic River, take place on private lands and use state-administered water rights with no Federal nexus. Thus existing land use patterns will not be affected by the known and foreseeable impacts of this alternative. Private parties and land owners carrying out activities with no Federal involvement would be unaffected by designation of a NEP and associated 4(d) rules and reestablishment of Rio Grande silvery minnow. Thus, there would be no direct or indirect effects on private land use as a result of the proposed action.

No direct impacts on the Rio Grande Wild and Scenic River are anticipated under this alternative. Aquatic habitat within the Rio Grande Wild and Scenic River may be improved as an indirect result of this alternative if actions are implemented under section 7(a)(1), discretionary conservation measures, to improve habitat for the Rio Grande silvery minnow. There would be no adverse direct or indirect effects on the Rio Grande Wild and Scenic River as a result of the proposed action.

This alternative would not have any adverse direct or indirect effects on recreation in the Big Bend reach. The National Park Service currently manages the river corridor in a manner that attempts to serve the needs of both recreation and preservation. No projections exist on general Big Bend National Park and Rio Grande Wild and Scenic River visitation, or use of the river

corridor in the coming years. Given the remoteness of the Big Bend region, it is unlikely that visitation and use rates will change dramatically in the near future. Recreational use of the river and adjacent riparian areas, including number and size of float trip launches, will continue to be regulated by Big Bend National Park under existing and/or forthcoming guidelines. There are no data which indicate that river use by rafters and campers would likely result in any adverse effect on the Rio Grande silvery minnow. Although human use of the Rio Grande corridor in Big Bend National Park does represent one possible source of contamination of river water, this impact is indistinguishable from, and is far less significant than, impacts from other sources.

To the extent that a NEP designation and reestablishment of Rio Grande silvery minnow would focus management attention on habitat improvement via removal of non-native species, such as salt cedar and giant river cane, this alternative would result in enhanced opportunities for wildlife viewing, enjoyment of natural ecological processes, and river access.

Impacts on Federal Agency Actions

The outcome of possible future section 7 consultations cannot be predicted or pre-judged, particularly if the consultations arise due to unforeseen or unusual events such as a river channel avulsion along the international border. However, impacts on Federal agencies in this reach appear to be minimal. Given the information at hand, no significant modifications to specific and foreseeable agency actions would be expected. There would be some economic cost to Federal agencies associated with section 7 implementation if a NEP is designated and Rio Grande silvery minnow are reestablished, however, the cost for section 7 consultation is expected to be relatively minor compared to the overall cost of any project planning and implementation. An indirect effect of the proposed action, is that critical habitat for the Rio

Grande silvery minnow could not be established in the Big Bend reach under this alternative because the ESA does not allow a NEP area and critical habitat to be designated in the same area.

National Park Service Consultations

The primary Federal agency that would be impacted under this alternative is the National Park Service. In the recent past, Big Bend National Park has engaged in informal section 7 consultations with the Service in conjunction with proposed general and river management scenarios, and for specific development and restoration projects. Past consultations have involved several listed species present in Big Bend National Park, including the peregrine falcon (now delisted), Big Bend gambusia, Mexican long-nosed bat, black-capped vireo, bunched cory cactus, and Chisos Mountain hedgehog cactus. Currently, no federally threatened or endangered species inhabit the Big Bend reach, so there is no history of consultations directly relevant to this alternative.

Under this alternative, current or foreseeable Big Bend National Park actions for which consultation may be required include: Water diversions from the Rio Grande at Castolon and Rio Grande Village; salt cedar removal; Recreational River Use Management Plan (National Park Service 1997); General Management Plan (National Park Service 2004); and, Rio Grande Wild and Scenic River Management Plan (National Park Service 2004). Under this alternative, consultations may take place to give special consideration to possible impacts on Rio Grande silvery minnow. However, it is not expected that present policies would have to be altered if a NEP is designated and Rio Grande silvery minnow are reestablished. In fact, although current and foreseeable salt cedar and giant river cane removal activities may have temporary negative

effects on Rio Grande silvery minnow and may require section 7 consultation, these actions would likely have a beneficial effect on Rio Grande silvery minnow in the long term.

A more detailed description of activities and management plans that may require section 7 consultations with Big Bend National Park can be found in the Designation of Critical Habitat for the Rio Grande Silvery Minnow: Final Impact Statement (Service 2001). Although the requirements for section 7 consultation would be different for critical habitat designation versus a NEP designation and reestablishment of Rio Grande silvery minnow, the activities that may require consultation would be similar.

International Boundary and Water Commission Consultations

The U.S. Section of the International Boundary and Water Commission is an independent Federal commission with jurisdiction over the Rio Grande channel from Percha Diversion Dam, Sierra County, New Mexico to the international boundary at El Paso, Texas-Ciudad Juarez, Chihuahua, Mexico. In the river's international reach, which extends to the Gulf of Mexico, both the U.S. and Mexican Sections of the International Boundary and Water Commission have authority. The International Boundary and Water Commission is charged with applying the boundary and water treaties between the two countries and settling differences that arise in the application of the treaties. Commission responsibilities include maintaining the river channel as an international boundary. Current or foreseeable actions of the U.S. Section of the International Boundary and Water Commission for which consultation might be required include boundary maintenance activities at stream gages within Big Bend National Park and Rio Grande Wild and Scenic River. However, such actions have been relatively infrequent along the international

reach of the Rio Grande. Much of the river corridor within Big Bend National Park and the Rio Grande Wild and Scenic River segment consists of fairly narrow and steep-walled canyons, in which a significant channel shift is unlikely. It is possible, however, that a future channel shift in this area would necessitate action by the International Boundary and Water Commission, in cooperation with Mexico. This alternative would require the U.S. Section of the International Boundary and Water Commission to consult before undertaking channel relocation or rectification projects in Big Bend National Park or Rio Grande Wild and Scenic River. In this unlikely event, the Service would work with the U.S. Section of the International Boundary and Water Commission to complete section 7 consultation in a timely and efficient manner. Under a NEP designation, section 7 consultations would not be required for actions that would not affect the species within Big Bend National Park or the Rio Grande Wild and Scenic River.

Customs and Border Patrol Consultations

The Service is currently working with Customs and Border Patrol to develop a stream-lined system for threatened and endangered species management and section 7 consultations along the U.S. border with Mexico, including the Big Bend reach. At this time it is unknown exactly what activities may be conducted by Customs and Border Patrol along the Big Bend reach.

Service Internal Consultations

If the Rio Grande silvery minnow is reestablished in the Big Bend reach, management for the species could require internal consultations by the Service. Such consultations may take place with regard to minnow rescue or relocation efforts, fish stocking, and vegetation management.

For all of the reasons described above, we would not expect there to be a significant change in land or water uses practices involving agriculture, grazing, ranching, conservation, or recreation from the current condition under this alternative.

4.1.2.2 Water Rights and Use

No direct impacts on stream flow or the availability of water for any use are anticipated under this alternative. No alteration of naturally occurring hydrological processes would result from the proposed designation of a NEP and reestablishment of Rio Grande silvery minnow. Flow conditions in this reach may be slightly improved if actions are implemented under section 7(a)(1), discretionary conservation measures, such as removal of non-native salt cedar in a significant portion of the reach. Another indirect effect may occur if implementation of this alternative provides further incentive to establish a water rights market. In this scenario water rights may be acquired legally from willing sellers or leasers such that water may remain in the river for downstream users, or as a beneficial use for fish and wildlife in the river corridor. For example, the Trans Pecos Water Trust, based in Alpine, Texas, is a non-profit organization that is currently working on developing such a system.

There would also be no direct or indirect effects of designation of a NEP and reestablishment of Rio Grande silvery minnow on existing water rights and management arrangements. The Texas Commission on Environmental Quality's Rio Grande Watermaster Office retains authority over the allocation and control of Rio Grande water south of Fort Quitman. There is no Federal nexus affecting the delivery of water in this region, and no privately or municipally held water rights would be affected. The exercise of rights held by Big Bend National Park is not expected to be

affected. No economic impacts associated with acquiring or reallocating water for instream flow are anticipated due to implementation of this alternative.

Because this alternative will not affect existing patterns of land and water use, no negative economic or social impacts, direct or indirect, are expected.

4.1.3 Cultural

No direct or indirect effects on cultural resources as a result of the proposed action have been identified.

4.1.3.1 Impacts on Indian trust resources

No Indian trust resources are involved or would be affected by designation of this reach as a NEP, nor from reestablishment of Rio Grande silvery minnow.

4.1.3.2 Environmental justice effects

Although the social and economic data cited above for Hudspeth, Jeff Davis, Presidio, Brewster, Terrell, Val Verde, and Crockett counties indicate that the population of these counties may be susceptible to environmental justice concerns associated with impacts to local economies, no actual environmental justice issues associated with the preferred alternative have been identified. The area proposed under this alternative consists largely of federally and State owned and/or managed lands, and any costs resulting from designation of a NEP and reestablishment of Rio Grande silvery minnow would be borne by Federal agencies. In addition, the proposed action will not directly or indirectly adversely affect water quality, quantity, use, or rights.

4.1.3.3 Impacts on cultural resources

Existing historic and archeological sites in Big Bend National Park and the Rio Grande Wild and Scenic River would be unaffected by any known or foreseeable impacts of NEP designation and reestablishment of Rio Grande silvery minnow. The potential for locating archeological sites in the floodplain zone is low, due to centuries of scouring and sedimentation. This alternative would not directly or indirectly cause changes in the character or use of any historic properties. No conflicts between designation of a NEP and reestablishment of Rio Grande silvery minnow and American Indian religious or cultural concerns have been identified.

4.2 Alternative B, No Action

4.2.1 Biophysical

4.2.1.1 Floodplains, Wetlands, Riparian Zones, and Native and Non-Native Vegetation

No direct impacts on floodplains, wetlands, riparian zones, and native or non-native vegetation are anticipated under this alternative. The present status of vegetation in the Big Bend reach, including threatened and endangered species, would remain unchanged if a NEP is not designated and Rio Grande silvery minnow are not reestablished. As an indirect effect, it is possible that some species and habitat types may suffer future declines if, as a result of a NEP not being designated and Rio Grande silvery minnow not being reestablished, there is less incentive to improve aquatic habitat in the Big Bend reach.

4.2.1.2 Fish and Wildlife

The Rio Grande Silvery Minnow Recovery Team stated in the draft revised Recovery Plan that it recognizes the necessity for reestablishing the Rio Grande silvery minnow in portions of its historic range outside of the Middle Rio Grande in New Mexico (Service 2007). Not implementing the proposed action may have a direct adverse affect on the potential for recovery of the Rio Grande silvery minnow by forgoing an opportunity to reestablish a population of Rio Grande silvery minnow in the Big Bend reach, which has been identified as the portion of the species historic range with the greatest potential for reestablishment. In addition, chances for the Rio Grande silvery minnow's eventual recovery and delisting may be reduced if, as a result of not designating a NEP and not reestablishing Rio Grande silvery minnow in the Big Bend reach, these areas could become further impaired as a result of less incentive to restore ecological processes and improve habitat in the Big Bend reach.

The present status of Rio Grande fish species and communities, threatened and endangered species, and other wildlife in the Big Bend reach is likely to remain unchanged if a NEP is not designated and Rio Grande silvery minnow are not reestablished. It is possible that some species may suffer future declines, as an adverse indirect effect of this alternative, if there is less incentive for habitat improvement projects than had the reestablishment occurred.

4.2.1.2 Water Quality

No direct or indirect impacts on water quality are anticipated under this alternative. Adverse impacts on water quality resulting from recent reductions in river flow, and from point and non-point sources upstream from the Big Bend reach in the U.S. and Mexico, would remain.

4.2.2 Social and Economic

A decision to forego designation of a NEP and reestablishment of Rio Grande silvery minnow would have no direct or indirect social or economic impacts in the Big Bend region.

4.2.2.1 Land Use

Land use on private and public lands would not be affected, directly or indirectly, by this alternative. Recreational use of Big Bend National Park and Rio Grande Wild and Scenic River would be largely unaffected by this alternative. The National Park Service will continue to exercise authority over recreational use of the river, and to maintain a permitting process that places limits on the size and number of private and commercial river rafting trips through Big Bend National Park and Rio Grande Wild and Scenic River.

Impacts on Federal Agency Actions

In and upstream from Big Bend National Park, and along the Rio Grande Wild and Scenic River, Federal actions would continue to be subject to existing environmental regulations. The National Park Service would continue to manage the river and riparian habitat within the Big Bend reach in such a way as to provide for recreation and to preserve the area's ecological character and biological diversity.

Impacts on Federal Agency Consultations

Under this alternative, no Federal agency would be required to consult under the provisions of ESA section 7 on impacts to Rio Grande silvery minnow. Therefore, there would be no direct or indirect effects from this alternative.

4.2.2.2 Water Rights and Use

A decision to forego designation and reestablishment would have no direct effect on existing water rights and management arrangements. Additionally, none of the factors currently affecting stream flow in the Big Bend reach would be influenced either positively or negatively by this alternative. No alteration of naturally occurring hydrological processes would result from a decision to forego designation and reestablishment. As an indirect effect, opportunities to conserve or improve the water resource in this reach may be reduced if, as a result of a NEP not being designated and Rio Grande silvery minnow not being reestablished, there is less incentive to pursue them.

4.2.3 Cultural

No direct or indirect effects would be expected to the cultural environment if the no action alternative is selected.

4.3 Summary and Cumulative Effects

Cumulative Regulations prepared by CEQ for implementing NEPA require Federal agencies to analyze and disclose effects that result from incremental impact of an action “when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time” (40 CFR 1508.7).

For all of the reasons described above, we do not expect there to be a significant change in land or water uses practices involving agriculture, grazing, ranching, or recreation from the current condition under the proposed action. Effects of the proposed action would consist primarily of the potential for additional discretionary conservation measures (such as under section 7(a)(1) of the Endangered Species Act) to conserve and/or improve aquatic habitat for the Rio Grande silvery minnow. For example, if a NEP area is designated in the Big Bend reach and Rio Grande silvery minnow are reestablished in the area, this may provide additional incentive and potential for funding for control of non-native species, such as salt cedar and giant reed. Salt cedar and giant reed are non-native species that have invaded large areas of the riparian corridor along the Rio Grande in the Big Bend reach. These species are often able to out-compete native vegetation, becoming quite dense in some areas, which leads to degraded riparian, aquatic, and foraging habitat and poor access to the river. There are currently pilot projects underway within the Big Bend reach to control these species and restore riparian and aquatic habitat on both public and private lands. The increased incentive to control these species to improve aquatic habitat for the Rio Grande silvery minnow could result in cumulative effects leading to improved ecological functioning, increased native habitat for fish and wildlife species, and clearer access to the river, and would be beneficial to the ecosystem, recreationists, landowners, ranchers, and farmers.

The only potentially adverse effect of the proposed action that has been identified is the cost and time required for additional section 7 consultations that may be needed for actions with a Federal nexus that may affect the Rio Grande silvery minnow within Big Bend National Park or the Rio

Grande Wild and Scenic River. This may create additional work-load for the Federal agencies involved, however, as stated earlier, we do not expect that there would be many section 7 consultations required, and therefore this effect should be minimal.

If the no action alternative is selected, there may be an adverse affect on the Rio Grande silvery minnow's potential for recovery. The Big Bend reach has been identified as the portion of the species range with the greatest potential for reestablishment. Therefore, if we forego this opportunity to reestablish the Rio Grande silvery minnow in the Big Bend reach, the possibility of recovering the species may be significantly reduced. The Rio Grande silvery minnow is an endangered species that currently occupies only about five percent of its historic range. Where it does occur in the wild, in the middle Rio Grande in New Mexico, it faces many threats to its survival including habitat fragmentation and degradation and dewatering of the river. Thus, the cumulative effect of not designating a NEP and not releasing Rio Grande silvery minnow into the Big Bend in addition to the threats to the species in its current range could adversely affect the species' ability to recover and eventually be removed from the list of endangered species.

5.0 List of Preparers

U.S. Fish and Wildlife Service

6.0 List of Agencies, Organizations and Persons Contacted

This list of agencies, organizations, and businesses contacted during the scoping period for this Draft Environmental Assessment is not exhaustive. In addition to those listed below, individual landowners, researchers, media outlets, and other interested parties were also contacted.

Albuquerque Metro Flood Control Authority
Albuquerque Wildlife Federation

Alpine Chamber of Commerce
Amarillo Chamber of Commerce
American Fisheries Society
Amigos Bravos
Audubon Society
Balmorhea Chamber of Commerce
Bandelier National Monument
Bernalillo County Commissioners
Big Bend National Park
Big Bend Natural History Association
Big Spring Chamber of Commerce
Brewster County Historical Commission
Brewster County Judge
Brownsville Chamber of Commerce
Carlsbad Irrigation District
Chaves County Commission
City of Albuquerque
City of Alpine
City of Carlsbad
City of Farmington
City of Fort Stockton
City of Las Cruces
Coalition of Arizona/NM Counties
Cochiti Pueblo
Conejos Water Conservation District
Crane Chamber of Commerce
Davis Mountains Trans-Pecos Heritage
De Baca Soil and Water Conservation District (NM)
Del Rio Chamber of Commerce
Desert Sports
Dona Ana County Board of Commissioners
Eddy County
El Paso County Water Improvement
El Paso Water Utilities
Elephant Butte Irrigation District
Far Flung Adventures
Federal Emergency Management Agency
Federal Highway Administration
Forest Guardians
Fort Stockton Chamber of Commerce
Friends of Big Bend National Park
Governor Bill Richardson
Governor Rick Perry
Hagerman-Dexter Soil & Water Conservation District (NM)
Honorable Senator Bingaman's Office
Hudspeth County Conservation Commission

International Boundary and Water Commission, Mexican Section
International Boundary and Water Commission, U.S. Section
Jicarilla Apache Nation
Lajitas Real Estate
Land and Water Fund
Los Alamos County Utilities
Lower Valley Water District (TX)
Marathon Chamber of Commerce
Marfa Chamber of Commerce
Mescalero Apache Tribe
Middle Rio Grande Conservancy District
Middle Rio Grande Council of Governments
National Audubon Society
National Park Service
National Parks and Conservation Association
New Mexico Acequia Commission
New Mexico Cattle Growers' Association
New Mexico Department of Agriculture
New Mexico Department of Game and Fish
New Mexico Energy, Minerals and Natural Resources Department
New Mexico Environment Department
New Mexico Farm and Livestock Bureau
New Mexico Highway and Transportation Department
New Mexico Interstate Stream Commission
New Mexico Museum of Natural History
New Mexico Office of the State Engineer
New Mexico State Lands Office
New Mexico State Parks and Recreation Division
New Mexico State Senate
New Mexico Wildlife Federation
Pecos Chamber of Commerce
Pecos River Compact Commissioner for Texas
Presidio Chamber of Commerce
Pueblo of Acoma
Pueblo of Cochiti
Pueblo of Isleta
Pueblo of Jemez
Pueblo of Laguna
Pueblo of Nambe
Pueblo of Picuris
Pueblo of Pojoaque
Pueblo of San Felipe
Pueblo of San Ildefonso
Pueblo of San Juan
Pueblo of Sandia
Pueblo of Santa Ana

Pueblo of Santa Clara
Pueblo of Santo Domingo
Pueblo of Taos
Pueblo of Tesuque
Pueblo of Zia
Rio Chama Acequia Association
Rio Grande Adventures/Outback Expeditions
Rio Grande Compact Commission
Rio Grande Conservation Commission
Rio Grande District Engineer (CO)
Rio Grande Institute
Rio Grande Restoration
Rio Grande Water User's Association
Sanderson Chamber of Commerce
Sandia National Laboratories
Sandoval County Commissioners
Santa Ana Pueblo
Santa Fe County Commissioners
Save Our Bosque Task Force
Sierra Club
Sierra County Board of Commissioners
Sierra Soil and Water Conservation District (NM)
Socorro County Board of Commissioners
Socorro Utilities-Gas & Water
Southern Appalachian Biodiversity Project
Southwest Environmental Center
State of Colorado Attorney General's Office
Texas Commission on Environmental Quality
Texas Department of Agriculture
Texas Farm Bureau
Texas Nature Conservancy
Texas Parks & Wildlife Department
Texas River Expeditions
Texas Rivers Protection Association
Texas Senator Frank Madla
Texas State Representative Lon Burnam
Texas State Representative Pete Gallego
Texas Water Commission
Texas Water Development Board
The Nature Conservancy
The Nature Conservancy, Mexico Program
Town of Taos, Water Resources Division
U.S. Army Corps of Engineers
U.S. Bureau of Indian Affairs
U.S. Bureau of Land Management
U.S. Bureau of Reclamation

U.S. Department of Transportation
U.S. Environmental Protection Agency
U.S. Geological Survey
U.S. Representative Ciro Rodriguez
U.S. Representative Heather Wilson
U.S. Representative Henry Bonilla
U.S. Representative Rubén Hinojosa
U.S. Representative Solomon Ortiz
U.S. Representative Steve Pearce
U.S. Representative Sylvestre Reyes
U.S. Representative Tom Udall
U.S. Senator Jeff Bingaman
U.S. Senator John Cornyn
U.S. Senator Kay Bailey Hutchison
U.S. Senator Pete Domenici
USDA Forest Service
USDA-APHIS Wildlife Services (New Mexico)
Uvalde Chamber of Commerce
Valencia County Board of Commissioners
Village of Los Lunas
Water Resources Research Institute
World Wildlife Fund
World Wildlife Fund, Chihuahuan Desert Project

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8.0 Appendix A – Scientific Names

Common Name

Scientific Name

Vegetation

Bermuda grass	<i>Cynodon dactylon</i>
Bunched Cory cactus	<i>Coryphantha ramillosa</i>
Chisos Mountain hedgehog cactus	<i>Echinocereus chioensis</i>
Common reed	<i>Phragmites communis</i>
Creosote bush	<i>Larrea tridentata</i>
Giant reed	<i>Arundo donax</i>
Huisache	<i>Acacia farnesiana</i>
Mesquite	<i>Prosopis spp.</i>
Saltbush	<i>Atriplex spp.</i>
Saltcedar (tamarisk)	<i>Tamarix ramosissima</i>
Willow	<i>Salix spp.</i>

Fish

Big Bend gambusia	<i>Gambusia gaigei</i>
Blue catfish	<i>Ictalurus furcatus</i>
Blue sucker	<i>Cycleptus elongatus</i>
Chihuahua shiner	<i>Notropis chihuahua</i>
Common carp	<i>Cyprinus carpio</i>
Conchos pupfish	<i>Cyprinodon eximius</i>
Flathead catfish	<i>Pylodictis olivaris</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Gray redhorse	<i>Moxostoma congestum</i>
Longnose dace	<i>Rhinichthys cataractae</i>
Longnose gar	<i>Lepisosteus osseus</i>
Mexican tetra	<i>Astyanax mexicanus</i>
Mexican stoneroller	<i>Campostoma ornatum</i>
Proserpine shiner	<i>Cyprinella proserpina</i>
Red shiner	<i>Cyprinella lutrensis</i>
Rio Grande shiner	<i>Notropis jemezianus</i>
Rio Grande silvery minnow	<i>Hybognathus amarus</i>
River carpsucker	<i>Carpiodes carpio</i>
Roundnose minnow	<i>Dionda episcopa</i>
Smallmouth buffalo	<i>Ictiobus bubalus</i>
Speckled chub	<i>Machrybopsis aestivalis aestivalis</i>
Tamaulipas shiner	<i>Notropis braytoni</i>
Texas shiner	<i>Notropis amabilis</i>
West Mexican redhorse	<i>Moxostoma austrinum</i>
Western mosquitofish	<i>Gambusia affinis</i>
White sucker	<i>Catostomus commersoni</i>
Yellow bullhead	<i>Ameiurus natalis</i>

Invertebrates

Texas hornshell

Popenaias popeii

Birds

Bald eagle

Haliaeetus leucocephalus

Bell's vireo

Vireo bellii

Black-capped vireo

Vireo atricapilla

Black-chinned hummingbird

Archilochus alexandri

Blue grosbeak

Guiraca caerulea

Common ground dove

Columbina passerina

Common yellowthroat

Geothlypis trichas

Elf owl

Micrathene whitneyi

Hooded oriole

Icterus cucullatus

Ladder-backed woodpecker

Picoides scalaris

Mourning dove

Zenaida macroura

Northern cardinal

Cardinalis cardinalis

Orchard oriole

Icterus spurius

Painted bunting

Passerina ciris

Peregrine falcon

Falco peregrinus

Southwestern willow
flycatcher

Empidonax trailii extimus

Summer tanager

Piranga rubra

Vermilion flycatcher

Pyrocephalus rubinus

Western screech-owl

Otus kennicottii

Western yellow-billed cuckoo

Coccyzus americanus occidentalis

White-winged dove

Zenaida asiatica

Yellow-breasted chat

Icteria virens

Mammals

Black bear

Ursus americanus

Gray fox

Urocyon cinereoargenteus

Mexican beaver

Castor canadensis

Mexican long-nosed bat

Leptonycteris nivalis

Mountain lion

Felis concolor

Nutria

Myocastor coypus

Raccoon

Procyon lotor

Striped skunk

Mephitis mephitis

Reptiles and Amphibians

Big Bend slider

Chrysemys scripta gaigeae

Big Bend patch-nosed snake

Salvadora deserticola

Blotched water snake

Natrix erthrogaster transversa

Canyon lizard

Sceloporus merriami annulatus

Checkered gartersnake

Thamophis marcianus

Coachwhip

Masticophis flagellum

**Reptiles and Amphibians
(cont.)**

Desert kingsnake

Desert spiny lizard

Elegant slider

Glossy snake

Great Plains rat snake

Marbled whiptail

Red-spotted toad

Rio Grande leopard frog

Side-blotched lizard

Southwestern earless lizard

Spiny softshell turtle

Spotted night snake

Texas banded gecko

Trans-Pecos blind snake

Western diamondback
rattlesnake

Yellow mud turtle

Notiosorex crawfordi

Sceloporus spp.

Trachemys scripta elegans

Arizona elegans

Eumeces obsoletus

Cnemidophorus tigris marmoratus

Bufo punctatus

Rana berlandieri

Uta stabsburiana

Holbrookia texana scitula

Apalone spinifera

Spermophilus spilosoma

Coleonyx brevis

Elaphe subocularis

Pseudacris triseriata

Kinosternon flavescens

9.0 Appendix B

Rio Grande Silvery Minnow Reestablishment in the Big Bend Reach of the Rio Grande: Implementation and Monitoring Plan

A. Introduction

1. Population Status of Rio Grande Silvery Minnow in the Big Bend Reach of the Rio Grande

In this document, “Big Bend reach” refers to the portion of the Rio Grande in Texas, from Mulato Dam, east of Presidio, Texas, through Big Bend National Park and the Rio Grande Wild and Scenic River. “Big Bend region” is used to refer to the geographic area of the Big Bend reach and surrounding lands.

The historical distribution of the Rio Grande silvery minnow included the Rio Grande from Española, New Mexico, through the Big Bend reach to the Gulf of Mexico, and the Pecos River from near Santa Rosa, New Mexico, to the confluence with the Rio Grande. Seven collections made between 1938 and 1960 documented that Rio Grande silvery minnow was among the most common fishes of the Big Bend reach. Despite several sampling events from 1977 to the present, the species has not been found in the area. There are no records of the silvery minnow in the Rio Conchos of Mexico in either historic or recent collections [U.S. Fish and Wildlife Service (Service) 2007].

Rio Grande silvery minnow is extirpated from the Big Bend reach of the Rio Grande and natural repopulation is not possible without human assistance (Service 2007). Reasons for the species’ extirpation in the Rio Grande in Texas are uncertain, but are believed to have been due to

drought and diversions, in combination with water pollution. However, continued presence of other native members of the pelagic spawning guild (e.g., speckled chub and Rio Grande shiner) is evidence that the Big Bend Reach may support reestablishment of Rio Grande silvery minnow.

2. Suitability of Big Bend Reach for Rio Grande Silvery Minnow Reestablishment

Based on the presence of suitable habitat, the presence of fish species that have similar habitat requirements, the recommendations of the Rio Grande Silvery Minnow Recovery Team, and the results of a feasibility study (Edwards 2005), the area in which silvery minnow are most likely to become reestablished after potential reintroduction is the Rio Grande from Mulato Dam near Presidio, Texas to Foster's Weir near the Terrell/Val Verde County line.

The Rio Grande Silvery Minnow Recovery Team (Recovery Team) developed a reach-by-reach analysis of the Rio Grande and Pecos River basins to identify the salient hydrological, chemical, and biological features of each reach. This analysis addressed the threats to the Rio Grande silvery minnow and considered the suitability of each reach for potential reestablishment (Service 2007).

The Recovery Team's reach-by-reach analysis considered: (1) the understanding of reasons for the species' extirpation from the selected reach; (2) the presence of other members of the reproductive guild (pelagic spawner; non-adhesive, semibuoyant eggs); (3) habitat conditions (including susceptibility to river drying and presence of diversion structures); and (4) the presence of congeners (i.e., other species of *Hybognathus*). The following list of reaches or portions of reaches were selected, in order of priority, to be most suitable for reestablishment (Service 2007):

1. Rio Grande, Presidio to Amistad Reservoir
2. Rio Grande, Amistad Reservoir to Falcon Reservoir
3. Pecos River, Sumner Dam to Brantley Reservoir
4. Pecos River, Red Bluff Reservoir to Amistad Reservoir
5. Rio Grande, Elephant Butte Reservoir to Presidio
6. Pecos River, Brantley Dam to Red Bluff Reservoir

More information on each reach and how the reaches were selected and prioritized can be found in the draft revised Recovery Plan (Service 2007). The following is an excerpt from the draft revised Recovery Plan regarding the suitability of the Big Bend Reach:

Hydrology: The Rio Grande in this reach is perennial, and is dominated by the Rio Conchos entering from the Mexico. Flow reductions only occurred during the severest droughts of the 1950s, until 2003, when portions of this reach again ceased to flow. There is a seasonal peak that is shortened due to water diversions and upstream dams in the Rio Conchos. There are large storm event peaks in October and November. There are increases in depletion anticipated, due to increased irrigation and storage capacity on the Mexican side of the river. The Treaty of 1944 sets the upper limit for the amount of diversion, but this may not be enforced.

This reach is not leveed and has small rock dam weirs. The substrate ranges from silt to cobble and boulder, depending on local conditions. There are no channel maintenance activities in this reach. Almost half of this reach is in canyons, including Big Bend National Park. The lower

canyon reach is outside Big Bend National Park, but land use is managed by the National Park Service as a part of the Rio Grande Wild and Scenic River designation in this stretch.

The channel is not mobile in the canyon sections. Outside the canyon reaches, the river is braided in some sections with a moderate gradient on average but higher gradient relative to the immediate upstream reach. Base flow in this reach is approximately 400 cfs.

Water quality: The river in this reach has high salinity and turbidity. This reach has both point and non-point source discharges, with the water quality dominated by contributions from the Rio Conchos, as well as perennial streams, and springs.

Fish community: This reach has a warm-water native fish community with some non-natives. The reach has a high number of large river species, such as smallmouth buffalo. The main predator is blue catfish. The Rio Grande silvery minnow was historically present in this reach, but is no longer present. There is no niche competition.

Reestablishment potential: Good.

Further study: Existing fish community, water quality data from the Rio Conchos.

B. Reestablishment Plan

1. Goal, Objective, and Tasks

a. Goal

The goal of this implementation and monitoring plan is to reestablish a self-sustaining population

of the federally endangered Rio Grande silvery minnow in potentially suitable habitat found within the species' historic range in the Rio Grande within the Big Bend area of Texas. The draft revised Recovery Plan defines a self-sustaining population as one that can sustain a minimum of 500,000 unmarked fish, for five consecutive years without augmentation from captive-bred fish (Service 2007).

b. Objective

The objective of this implementation and monitoring plan is to establish a two-year class population of Rio Grande silvery minnow into the Big Bend reach of the Rio Grande and to monitor the population, including reproduction and genetics.

c. Tasks

1. Raise Rio Grande silvery minnow in captivity. Eggs collected from the wild are the preferred source for Rio Grande silvery minnow raised in captivity for this reestablishment effort. However, Rio Grande silvery minnow will be raised from eggs spawned in captivity, if needed.
2. Stock fish in Big Bend reach of Rio Grande (including site preparation such as installation of holding pens).
3. Genetic monitoring.
4. Monitoring of Rio Grande silvery minnow population in Big Bend reach of Rio Grande.

d. Estimated Expenses

The following budget is based on needs between January 2008 and December 2008, with out-year estimates for 2009 – 2012.

Task	Cost Estimate
Propagation	
Additional FWS Facility	100,000
Release	
Transportation	2,000
Soft Release (Site Prep / Nets) – 2008 only	5,000
Genetic Monitoring	
Pre-release screening	20,424
Wild population monitoring	20,424
Population Monitoring (4 trips/year)	
3 staff x 5 days x 4 trips = 60 days @ \$500/day	30,000
Reproduction Monitoring (30 days/year)	20,000
Estimate 2008	197,848
Out-year Estimate 2009 (3%)	203,633
Out-year Estimate 2010 (3%)	209,742
Out-year Estimate 2011 (3%)	216,034
Out-year Estimate 2012	222,515
Total 5 year (2008-2012)	\$1.05 M

2. Risks

Releasing captive-reared fish into the wild is not without risks. Genetic and ecological risks must be considered along with the possible benefits of the reestablishment efforts.

a. Genetic Risks

Researchers investigating the genetics of the Rio Grande silvery minnow in the Rio Grande in New Mexico have found that there are genetic consequences to capturing Rio Grande silvery minnow eggs in the wild, transporting them to rearing facilities, and repatriating these individuals (Alò and Turner 2005; Osborne et al. 2006). There are two primary risks to genetic resources associated with captive propagation: (1) loss of genetic diversity at all genetic loci, and (2) imposition of artificial selection on wild genotypes. Researchers (Alò and Turner 2005; Osborne et al. 2005a, b) found that the mean estimate of genetic effective size of Rio Grande silvery minnow in the wild was below that required to maintain > 95% of genetic variation at a neutrally-evolving genetic locus over the long term. Researchers have also concluded that any Rio Grande silvery minnow reestablishment efforts require using individuals from a genetic source that is already less than optimum (Alò and Turner 2005; Osborne et al. 2005, 2006). In addition, in comparing wild and captive stocks, they found that rare alleles present in wild populations have been lost in captive stocks and stocks reared from wild-caught eggs have exhibited higher rates of inbreeding than wild stocks. Although maximizing the size, time, and geographic sampling of broodstock can reduce these effects, they cannot eliminate them (Alò and Turner 2005; Osborne et al. 2005, 2006).

b. Ecological Risks

Ecological concerns associated with stocking captive-reared Rio Grande silvery minnow in the wild include pathogen and parasite transmission, and intra- and inter-specific actions including competition and predation, and fitness. To minimize the risks of pathogen and parasite

transmissions, samples from all sources of stocked fish will be analyzed for presence and extent of pathogens and parasites before transfer or stocking into Rio Grande habitats per Service protocol.

The Rio Grande silvery minnow to be released in Big Bend are adapted to the natural conditions found in the Rio Grande in New Mexico. It is unknown how these individuals will adapt to the different conditions found in the Big Bend reach, including hydrology, seasonality of spawning cues, and habitat availability. Additionally, the species complex found in the Big Bend reach is somewhat dissimilar to that found in its current range in the Rio Grande in New Mexico: there are more native species that share similar spawning habits and life history strategies with the Rio Grande silvery minnow and fewer non-native species in Big Bend. Habitat requirements of Rio Grande silvery minnow may overlap with current resident populations. The effects that these interactions may have on either species are unknown but may include displacement and predation. Post-release monitoring of Rio Grande silvery minnow will allow us to track the relative abundance of various fish species, which will help us to understand if there are effects from releasing Rio Grande silvery minnow in the Big Bend reach on other species and whether further research will need to be done.

3. Source of Fish

The source of silvery minnow for releases in the Big Bend reach will likely be from the Service's Dexter National Fish Hatchery and Technology Center, or another Service facility assigned to provide fish specifically for this purpose.

4. Age, Size, and Number of Fish

a. Age 1 (50-60 mm Standard Length minimum)

Year 1 = 150K (One year only, assuming equal survival of both age classes)

b. Age 0 (40 mm Standard Length minimum)

Year 1 = 50K

Year 2 = 200K

Year 3 = 200K

Year 4 = 200K

Year 5 = 200K

Years 6 – 10 will be determined based on results from first 5 years.

5. Release Sites and Procedures

a. Release Sites

Based on the presence of suitable habitat, the presence of fish species that have habitat requirements similar to the silvery minnow, the recommendations of the Recovery Team, and the results of the feasibility study mentioned above, we believe that the Rio Grande, from Mulato Dam (near the western border of Big Bend Ranch State Park) to Foster's Weir, east of the Terrell/Val Verde county line, is suitable for the reestablishment of the silvery minnow under a Non-essential Experimental Population (NEP) designation. Therefore, we plan to release the silvery minnow into its historic habitat in this area.

Release sites will initially be located in Big Bend National Park and potentially on Texas Parks and Wildlife Department lands. Releases on privately owned lands would occur only if landowners are agreeable and have potentially suitable habitat. Primary considerations for identifying silvery minnow release sites include:

1. Within or in proximity to potentially suitable habitat.
2. The extent of potentially suitable habitat surrounding a potential release site and its proximity to other similar habitats.
3. Access for logistical support.
4. Willing landowner or manager.

A number of potential release sites have been identified that have a combination of demonstrably suitable habitats and ease of access by vehicle (Edwards 2005). Arranged from upstream to downstream throughout the study area, the potential release sites identified include:

1. Colorado Canyon Access in Big Bend Ranch State Park
2. Contrabando Canyon Access in Big Bend Ranch State Park
3. Mouth of Terlingua Creek in Big Bend National Park
4. Santa Elena Canyon River Access in Big Bend National Park
5. Hot Springs in Big Bend National Park
6. Boquillas Canyon Access in Big Bend National Park
7. Dryden Crossing

b. Release Procedures

As part of the silvery minnow augmentation program in New Mexico, the Service evaluated different release strategies such as time of year, time of day, specific release habitats, and various hatchery environments (natural outdoor ponds versus indoor facilities). All this information adds

to our knowledge of the species and will assist us in future recovery actions, such as providing management strategies for the proposed reestablishment of silvery minnow in the Big Bend reach. For example, preliminary results have verified the importance of low-velocity habitat of sufficient depth (> 0.5 m) for release; these habitats provide areas for cover and acclimation to riverine conditions after release (Service 2007).

Initial releases will likely be conducted once per year at two release sites. Transplanted fish will be “tempered” in the Rio Grande prior to their release (Edwards 2005). The Texas Parks and Wildlife Department’s Heart of the Hills Fisheries Science Center has extensive data on this technique, and its success. Holding pens will be installed at release sites to hold Rio Grande silvery minnow prior to final release, thus allowing acclimatization to riverine conditions, reducing predation and reducing downstream dispersal. This method is also known as a “soft release.” Release procedures and conditions will be carefully documented and analyzed to allow for adaptive management.

6. Genetic monitoring

The draft revised Rio Grande Silvery Minnow Recovery Plan (draft revised Recovery Plan; Service 2007) recommends that genetic monitoring should be conducted on reintroduced populations to ensure that genetically diverse individuals are restocked, and to track the fate of genetic diversity in the reintroduced populations over time. Genetic monitoring will follow a detailed protocol similar to that designed in the Middle Rio Grande of New Mexico to provide critical information in a timely manner. The results of such a study will provide important genetic guidelines for future restocking efforts (Service 2007).

7. Population Monitoring

The draft revised Recovery Plan recommends using the Middle Rio Grande Long-Term Fish Population Monitoring Program methodology as the model in the development and implementation of a sampling protocol for a long-term fish monitoring program. It is important for monitoring programs to be able to build on existing data and to be able to use statistically valid methods to assess changes in age-class structure and abundance of Rio Grande silvery minnows and other fish. The Middle Rio Grande Long-Term Fish Population Monitoring Program (see *Appendix*) has already established a methodology and provides a historical context.

Initially, one year of monitoring will be conducted to collect baseline information at selected monitoring sites. This information will allow accurate assessment of future trends in fish community structure. Post-release population monitoring will be conducted a minimum of once per year in October. Typically, October is a good month to monitor to capture a snapshot of the population, and get some information about both adult and young-of-year survival. Depending on available resources, population monitoring will most likely be conducted at least quarterly during the first year or two of releases, which will help monitor not only survival and relative abundance, but also signs of reproductive activity (gravid females, young-of-year, etc.).

8. Adaptive Management

As stated in the draft revised Recovery Plan, it will be necessary to periodically review, evaluate, and revise research and management activities to ensure progress toward recovery of the Rio Grande silvery minnow. Monitoring will determine the success and future direction of the reestablishment project. As phases of the project are completed or relevant findings verified,

new information may identify additional or alternative methods, research, or recovery actions that may be needed (Service 2007).

C. Recommendations for Habitat Improvement

The presence of suitable habitat for all life stages of the Rio Grande silvery minnow will be vital to the success of this reestablishment effort. To ensure needed habitat elements exist and for landowners and managers wishing to create or conserve silvery minnow habitat, we recommend the measures below. In particular, we recommend control of salt cedar (*Tamarix sp.*) and giant river cane (also known as giant reed; *Arundo donax*) in the floodplain of the NEP area and upstream of this area. The presence and abundance of these plant species have stabilized banks and sediments, caused scouring of sand and silt substrates from the river and reduced channel braiding, thus effectively reducing the amount of Rio Grande silvery minnow habitat (Edwards 2005).

We anticipate working with land managers and owners and other interested parties, on a voluntary basis, to develop plans to further guide habitat management. More detailed information about each of the recommendations below can be found in the draft revised Recovery Plan and the document, Feasibility of Reintroducing Rio Grande Silvery Minnows (*Hybognathus amarus*) to the Rio Grande, Big Bend Region, Texas (Edwards 2005). The following recommendations should be addressed simultaneously:

1. Control of salt cedar (*Tamarix sp.*) and giant river cane (also known as giant reed; *Arundo donax*) in the floodplain of the reestablishment area and upstream of this area.

2. Continue coordination with Mexico to ensure timely and consistent treaty water deliveries to the Rio Grande/Rio Bravo del Norte in the Big Bend region.
3. Encourage flows within the Big Bend reach that support Rio Grande silvery minnow recruitment and maintain populations throughout the year.
4. Within existing legal authorities, implement all measures to increase water use efficiencies and conservation.
5. Implement a comprehensive program of data collection on water supply and use for improvement of water and habitat management.

D. Recommended Research

Further examination of the Rio Grande silvery minnow, its relationships with other species, and its habitat conditions in the Big Bend reach will be important in helping to guide adaptive management for this reestablishment effort. More detailed information about each of the recommendations below can be found in the draft revised Recovery Plan and the document, Feasibility of Reintroducing Rio Grande Silvery Minnows (*Hybognathus amarus*) to the Rio Grande, Big Bend Region, Texas (Edwards 2005). The following recommendations should be addressed simultaneously:

1. Monitor and study the effects of salt cedar and giant cane removal on the quality and quantity of Rio Grande silvery minnow habitat in the Big Bend reach.
2. Further study the existing fish community in the Big Bend reach.
3. Develop a better understanding of water quality in the Rio Grande within and upstream of the reestablishment area, including water entering from the Rio Conchos.
4. Evaluate historical flow data, both pre- and post-impoundment on the Rio Grande and Rio Conchos, to better understand the historical flow regime in the Big Bend reach.
5. Examine the timing of spawning of Rio Grande silvery minnow in the Big Bend reach, which may have seasonally different spawning cues than those in the Rio Grande in New Mexico.
6. Determine the effects of various stocking conditions and release sites on Rio Grande silvery minnow.
7. Estimate the minimum viable population size for maintaining healthy populations within each reach and for re-introduction areas.
8. Use standard geomorphological and GIS techniques to determine extent of the floodplain in all reaches and the area of inundation at peak flows between April and November (when Rio Grande silvery minnow may respond to increases in flow by spawning).

9. Measure channel degradation and aggradation trends.
10. Investigate the potential of habitat construction that, during periods of low flow, will provide suitable habitat for the Rio Grande silvery minnow.
11. Develop a larval fish key for the Big Bend reach.
12. Develop and implement a sampling methodology of sufficient rigor to generate a statistically reliable population estimate for each population of Rio Grande silvery minnow.
13. Establish and maintain a single, centralized, standardized database for storage and retrieval of hydrologic, biologic, economic, and social data, including both stockings and captures of target species, and collect and maintain specimens in a research museum.

E. References Cited

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APPENDIX

MIDDLE RIO GRANDE LONG-TERM FISH POPULATION MONITORING PROGRAM

The following describes the population monitoring sampling protocol that has been used in recent years in the middle Rio Grande to monitor Rio Grande silvery minnow populations. This protocol is to be used to assess whether future Rio Grande silvery minnow populations meet the recovery objectives and criteria outlined in the draft revised Rio Grande Silvery Minnow Recovery Plan (Service 2007).

A total of 20 sampling sites have been monitored monthly to assess general trends in abundance, distribution, and composition of middle Rio Grande fishes, including Rio Grande silvery minnow, over time (Dudley et al. 2005). The Angostura Reach has five sampling localities, the Isleta Reach has six, and the San Acacia Reach has nine. The 20 sampling sites in the middle Rio Grande overlap the current range of Rio Grande silvery minnow. Sites were chosen based on access.

Sampling sites were chosen from more than 100 possibilities, based on a variety of factors, including access, land ownership, spatial location within reaches and between reaches, and overall suitability for effective and efficient sampling. Most have been sampled consistently since 1993, although several sites were added over time to increase the spatial extent of sampling (e.g., Angostura Diversion Dam, Isleta Reach area, and downstream of the San Marcial railroad bridge). Also, the temporal frequency of monitoring has increased from quarterly (1993-1997), to bimonthly (1999-2001), to monthly (2002-2005).

Fish are collected by rapidly drawing a two-person 3.1 m (wide) x 1.8 m (high) small mesh (ca. 5 mm) seine through discrete mesohabitats. The effective width of the seine during active sampling was 2.5 m. During spring and summer, a 1.0 m x 1.0 m fine mesh (ca. 1.5 mm) seine is used to selectively sample shallow, low-velocity habitats for larval fish. The total length of each sampling site is 200 m upstream to downstream. A total of about 15-20 seine hauls (median=17 seine hauls) are typically made at each sampling site unless conditions do not permit this (i.e., extremely high discharge or lack of flow). Each mesohabitat type (see Dudley et al. 2005 for definitions) present at the site (e.g., main channel pool, backwater, riffle, side channel run, etc.) is sampled. There are usually about 5-10 mesohabitat types present at a site. The total length of each seine haul varies, based on the size and availability of mesohabitats (i.e., some mesohabitats, like backwaters, are small or absent) but is generally about 15 m. Overall sampling area per site is about 600 m². Similar mesohabitat locations are sampled within a site during monthly monitoring efforts, with the exception of during extremely high or low discharge periods. The percent allocation of sampling effort (by mesohabitat type) is approximately equal among reaches (Dudley et al. 2005). Catch-per-unit-effort (CPUE) is calculated as the total number (#) of fish collected \cdot area sampled⁻¹ \cdot 100 (i.e., N [fish] \cdot effective seine width [m⁻¹] \cdot haul length [m⁻¹] \cdot 100), to yield #/100m². Isolated pools are not included in the calculation of CPUE as fish are artificially concentrated in these areas.

Annual reproduction is documented using an egg collecting device (Moore Egg Collector, MEC) developed specifically for the collection of large numbers of live and undamaged semibuoyant fish eggs (Altenbach et al. 2000). Catch rate of Rio Grande silvery minnow eggs in the middle

Rio Grande is determined following the sampling protocol described in Altenbach et al. (2000).

A mechanical flow-meter is attached to the MEC so that volume of water filtered can be calculated and catch rate per unit of water determined. The CPUE of drifting eggs is calculated as the total number of eggs collected \cdot volume of water sampled⁻¹ \cdot 100 (i.e., N [eggs] \cdot m³ water⁻¹ \cdot 100), to yield #/100m³.

Previous studies have demonstrated May and June as the primary period of Rio Grande silvery minnow spawning activity. The normal sampling regime is comprised of three daily efforts (morning, noon, and evening), each of two-hour duration. Two MECs are operated simultaneously to increase the volume of water and number of eggs sampled per unit of time.

References

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