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ENVIRONMENTAL ASSESSMENT

DESIGNATION OF CRITICAL HABITAT FOR THE SPIKEDACE (*Meda fulgida)* AND THE LOACH MINNOW *(Tiaroga [=Rhinichthys] cobitis)*

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1.0 Purpose

The purpose of this action is to designate critical habitat for spikedace (*Meda fulgida*) and loach minnow (*Tiaroga* [=*Rhinichthys*] *cobitis*) pursuant to section 4 of the Endangered Species Act of 1973, as amended (Act) by legally designating those areas that are essential to the survival and recovery of spikedace and loach minnow and describing those physical and biological features within those areas that require special management considerations to achieve conservation of the species. The purpose of critical habitat designation is to assist in achieving long-term protection and recovery of spikedace and loach minnow and the ecosystems upon which they depend.

1.1 Need for the Action

The need for the action is to conserve spikedace and loach minnow through compliance with section 4 of the Act. Critical habitat previously designated for spikedace and loach minnow was set aside by order of the Federal courts in Catron County Board of Commissioners, New Mexico v. U. S. Fish and Wildlife Service, CIV No. 93-730 HB (D.N.M., Order of October 13, 1994). The court cited our failure to analyze the effects of critical habitat designation under the National Environmental Policy Act (NEPA) as its basis for setting aside critical habitat for the two species. As a result, we removed critical habitat for spikedace and loach minnow on March 25, 1998 (63 FR 14378). More recently, the court directing us to complete designation of critical habitat for spikedace and loach minnow by February 17, 2000 (Southwest Center for Biological Diversity v. Clark, CIV 98-0769 M/JHG).

1.2 Background

Spikedace

Spikedace is a small, stream-dwelling fish endemic to the Gila River system of Arizona and New Mexico, USA, and Sonora, Mexico (Miller and Winn 1951, Miller and Hubbs 1960, Minckley 1973). Although the biology of this unique, monotypic genus is relatively well known among southwestern stream fishes (Barber *et al.* 1970, Anderson 1978, Schreiber and Minckley 1981, Barber and Minckley 1983, Propst *et al.* 1986), substantial gaps still exist and the basic ecology of the spikedace remains in need of further study. Spikedace was apparently not considered imperiled by Miller (1961), although it had by 1937 been locally extirpated from much of the Salt River, Arizona, and elsewhere (Miller 1961). Marked reduction in its over-all range was noted by Barber and Minckley (1966) and widespread depletions were reported by Minckley (1973). Once widely distributed among moderate-sized, intermediate-elevation streams in the Gila River system,

at least upstream of Phoenix, Arizona, spikedace is now restricted to scattered populations in relatively short stream reaches.

Spikedace were historically abundant in the San Pedro River, Arizona, and although never collected in that stream in Sonora, Mexico, probably occurred there also (Miller and Winn 1951). Distribution in Arizona was widespread in large and moderate-sized rivers and streams, including the Gila, Salt, and Verde rivers and their major tributaries, upstream of the present Phoenix metropolitan area, and the Agua Fria, San Pedro, and San Francisco river systems (Minckley 1973, Rhode 1980). Populations transplanted from Aravaipa Creek into Sonoita Creek, Santa Cruz County in 1968, and 7-Springs Wash, Maricopa County in 1970, have since been extirpated (Minckley and Brooks 1985). Distribution in New Mexico was in both the San Francisco and Gila rivers (Koster 1957, Propst *et al*. 1986, Sublette *et al*. 1990), including the East, Middle, and West forks of the latter. There are no records of spikedace transplants in New Mexico.

Spikedace is now restricted to approximately 445 kilometers (km) (276 miles [mi]) of stream in portions of the upper Gila River (Grant, Catron, and Hidalgo counties, New Mexico), middle Gila River (Pinal County, Arizona), lower San Pedro River (Pinal County, Arizona), Aravaipa creek (Graham and Pinal counties, Arizona), Eagle Creek (Graham and Greenlee counties, Arizona), and the Verde River (Yavapai County, Arizona) (Anderson, 1978, Bestgen, 1985, Propst *et al*. 1985, Propst *et al*. 1986, Sublette *et al*. 1990, Marsh *et al*. 1990, Jakle, 1992, Bettaso *et al*. 1995, Stefferud and Rinne 1996). The present range is only about 10-15% of the historic range and the status of the species within occupied areas ranges from common to very rare. At present the species is common only in Aravaipa Creek and some parts of the upper Gila River in New Mexico.

Spikedace live in flowing water with moderate to swift velocities over sand, gravel, and cobble substrates (Propst *et al*. 1986, Rinne and Kroeger 1988). Specific habitat for this species consists of shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at downstream riffle edges (Propst *et al*. 1986). Spikedace spawns from March through May with some yearly and geographic variation (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). Actual spawning has not been observed, but spawning behavior indicates eggs are laid over gravel and cobble where they adhere to the substrate. Individual spikedace live about two years with reproduction occurring primarily in one-year old fish (Barber *et al*. 1970, Anderson 1978, Propst *et al*. 1986). It feeds primarily on aquatic and terrestrial insects (Schreiber 1978, Barber and Minckley 1983, Marsh *et al* 1989).

Recent taxonomic and genetic work on spikedace indicate there are substantial differences in morphology and genetic makeup between remnant spikedace populations. Remnant populations occupy isolated fragments of the Gila basin and are isolated from each other. Anderson and Hendrickson (1994) found that spikedace from Aravaipa Creek is morphologically distinguishable from spikedace in the Verde River, while spikedace from the upper Gila River and Eagle Creek have intermediate measurements and partially overlap the Aravaipa and Verde populations. Mitochondrial DNA and allozyme analyses have found similar patterns of significant geographic

variation within the species (Tibbets, 1993).

Spikedace continues to decline and is threatened by a wide variety of habitat alteration and loss and non-native species pressures. Although the species is currently listed as threatened, we found that a petition to reclassify the species as endangered is warranted. A reclassification proposal is pending, however, work on it is precluded due to work on other higher priority listing actions (USFWS 1994).

Loach Minnow

The loach minnow is a small secretive fish endemic to the Gila River basin of Arizona and New Mexico, USA, and Sonora, Mexico. Although this unique species has been known to science for more than a century, relatively little is understood of its basic ecology. Loach minnow were apparently not considered imperiled by Miller (1961) and later by Minckley (1973). It once was locally abundant in suitable habitats in the Gila River system upstream of Phoenix, Arizona, but today is restricted to scattered tributary populations in Arizona and New Mexico.

Loach minnow was recorded in Mexico only in Rio San Pedro, in extreme northern Sonora (Miller and Winn 1951). Distribution in Arizona included the Salt River mainstem near and above Phoenix, White River, East Fork White River, Verde River, Gila River, San Pedro River, Aravaipa Creek, San Francisco River, Blue River, and Eagle Creek, plus major tributaries of larger streams (Minckley 1973, Rhode 1980; University of Michigan Museum of zoology, unpublished records). Populations transplanted from Aravaipa Creek into Sonoita Creek (Santa Cruz County, Arizona) in 1968 and Seven-Springs Wash (Maricopa County, Arizona) in 1970 have since been extirpated (Minckley and Brooks 19850. Distribution in New Mexico included the Gila River (including East, Middle, and West forks), San Francisco River, Tularosa River, and Dry Blue Creek; there have been no recorded transplants of loach minnow in New Mexico or Sonora.

Loach minnow is believed extirpated from Mexico, although the Gila River drainage in that country still lacks adequate surveys. Loach minnow is now restricted to approximately 645 km (400 miles) of stream in portions of the upper Gila River (Grant, Catron, and Hidalgo counties, New Mexico), the San Francisco and Tularosa rivers and their tributaries Negrito and Whitewater creeks (Catron County, New Mexico), the Blue River and its tributaries Dry Blue, Campbell Blue, Little Blue, Pace and Frieborn creeks (Greenlee County, Arizona, and Catron County, New Mexico), Aravaipa Creek and its tributaries Turkey and Deer creeks (Graham and Pinal counties, Arizona), Eagle Creek (Graham and Greenlee counties, Arizona), the White River (Apache, Gila, and Navajo counties, Arizona), and the Black River (Apache and Greenlee counties, Arizona (Barber and Minckley 1966, Britt 1982, Propst *et al*. 1985, Leon 1989, Marsh *et al*. 1990, Propst and Bestgen 1991, Bettaso *et al* 1995, Springer 1995, Bagley *et al*. 1996, Bagley *et al*. 1998, Propst 1996). The present range is only 15-20% of the historic range and the status of the species within occupied areas ranges from common to very rare. At present, the species is common only in Aravaipa Creek and the Blue River in Arizona and limited portions of the San Francisco, upper

Gila, and Tularosa rivers in New Mexico. The present range is only 15-20 % of the historic range.

The loach minnow is a bottom-dwelling inhabitant of shallow, swift water over gravel, cobble, and rubble substrates (Rinne 1989, Propst and Bestgen 1991). Loach minnow uses the spaces between, and in the lee of, larger substrate for resting and spawning (Propst *et al*. 1988, Rinne 1989). It is rare or absent from areas where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). Some studies have indicated that the presence of filamentous algae may be an important component of loach minnow habitat (Barber and Minckley 1966). The life span of loach minnow is about 2 years (Britt 1982, Propst and Bestgen 1991). Loach minnow feeds exclusively on aquatic insects (Schreiber 1978, Abarca 1987). Spawning occurs in March through May (Britt 1982, Propst *et al*. 1988); however under certain circumstances loach minnow may also spawn in the autumn (Vives and Minckley 1990). The eggs of loach minnow are attached to the underside of a rock that forms the roof of a small cavity in the substrate on the downstream side. Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al*. 1988, Vives and Minckley 1990).

Recent biochemical genetic work on loach minnow indicate there are substantial differences in genetic makeup among remnant loach minnow populations (Tibbets 1993). Remnant populations occupy isolated fragments of the Gila River basin and are separated from each other. Based on her work, Tibbets (1992, 1993) recommended that the genetically distinctive units of loach minnow should be managed as separate units to preserve the existing genetic variation.

Loach minnow are declining rangewide. Although it is currently listed as threatened, we found that a petition to reclassify the species as endangered is warranted. A reclassification proposal is pending, however work on it is precluded by work on other higher priority listing actions (USFWS 1994).

Reasons for the Decline of Spikedace and Loach Minnow

Distribution and abundance of both spikedace and loach minnow have been dramatically reduced in the past century (Minckley 1973, Propst *et al*. 1986, USFWS 1991a and 1991b). Past changes in range and density must have occurred in response to natural spatial and temporal variations in the environment, but the current threatened status of spikedace and loach minnow appears to be a direct or indirect result of human activities.

Habitat destruction or alteration and interactions with non-native aquatic species have acted both independently and in concert to extirpate or deplete spikedace and loach minnow populations. Habitat destruction and alteration has occurred due to numerous human uses of the stream, floodplain, and watershed, such as livestock grazing, agriculture, timber harvest, mining, roads, urban and suburban development, irrigation, water diversion, impoundment, flood control and repair, channelization, vegetation manipulation, groundwater pumping, gravel mining, fuelwood harvest, recreation, and others (Miller 1961, Rinne 1975, Minckley and Deacon 1991, USFWS

1991a and 1991b, Cain *et al*. 1997). Erosion, sedimentation, channel downcutting, changes in channel morphology, channel instability, and loss of surface water commonly resulted from human activities causing further loss and alteration of spikedace and loach minnow habitat (Leopold 1946, Dobyns 1981, Williams *et al*. 1985). In the San Pedro and Aqua Fria rivers, plus major reaches of the Salt and Gila rivers, dewatering and other such drastic habitat modifications resulted in demise of most native fishes. Downstream reaches of the Verde, Salt, and mainstem Gila rivers have been affected by impoundments and highly-altered flow regimes. Neither spikedace nor loach minnow persist in reservoirs or other non-flowing waters and downstream from the dams impacts ranged from dewatering to altered chemical and thermal conditions.

Introduction of non-native aquatic species has adversely affected spikedace and loach minnow through predation, competition, habitat alteration, community disruption, and disease (Miller 1961, Propst *et al.* 1986, Propst and Bestgen 1991, Minckley 1991, Douglas *et al* 1994). Non-native aquatic species that adversely affect spikedace and loach minnow include parasites and diseases, invertebrates, plants, amphibians, and reptiles, although non-native fish have been the most clearly detrimental, including smallmouth bass (*Micropterus dolomieui*), green sunfish (*Lepomis cyanellus*), red shiner (*Cyprinella lutrensis*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictus olivaris*), black and yellow bullhead (*Ameiurus melas* and *natalis*), western mosquitofish (*Gambusia affinis*), brown trout *(Salmo trutta)*, and rainbow trout (*Oncorhynchus mykiss*).

1.3 Boundaries and Elements of Critical Habitat

Critical habitat is defined in section 3(5)(A) of the Act as "(i) the specific areas within the geographical area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (III) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species." The term "conservation," as defined in section 3(3) of the Act, means "to use and the use of all methods and procedures which are necessary to bring an endangered species or threatened species to the point at which the measures provided pursuant to this Act are no longer necessary," i.e., the species is recovered and removed from the list of endangered and threatened species.

In identifying areas as critical habitat, we consider those physical and biological attributes that are essential to a species' conservation. In addition, the Act stipulates that the areas containing these elements may require special management considerations or protection. Such physical and biological features, as outlined in 50 CFR 424.12, include, but are not limited to, the following:

- Space for individual and population growth, and for normal behavior;
- Food, water, or other nutritional or physiological requirements;
- Cover or shelter;
- Sites for breeding, reproduction, or rearing of offspring; and

" Habitats that are protected from disturbances or are representative of the historic geographical and ecological distributions of a species.

2.0 Description of Alternatives

The Service considered the no action alternative as required by the National Environmental Policy Act (NEPA). The Action Alternative is to designate critical habitat as proposed in the Federal Register on December 1, 1999. The Service also considered alternatives to designate additional areas as critical habitat and to exclude areas from critical habitat.

2.1 No Action Alternative. The no action alternative is defined as a decision to forgo the designation of critical habitat for spikedace and loach minnow. This alternative would have no significant impacts beyond those impacts already resulting from the 1986 listing of spikedace and loach minnow (51 FR 23769 and 51 FR 39468 respectively) and associated requirements of section 7 of the Act. The alternative serves to delineate the existing environment and conditions that are anticipated to result from the listing of the species, without designation of critical habitat. On September 20, 1999 the U.S. District Court for New Mexico issued an order compelling the Service to designate critical habitat for spikedace and loach minnow (Southwest Center for Biological Diversity vs. Clark CIV 98-0769M/JHG.

2.2 Designation Identical to the 1994 Final Rules. The 1994 final rules designating critical habitat for spikedace and loach minnow were based on proposed designations published in 1985. Those proposals were based on information about the two fishes that was current in 1983. Seventeen years have passed and there have been substantial changes in the status of the two species and their habitats, the human activities that affect them, the information available, and the technology of habitat restoration. Opportunities have been foreclosed and others have become available. Therefore, a proposed critical habitat that included only those areas proposed in 1985 and finalized in 1994, would not conform to the requirement of the Endangered Species Act to consider all of the best available scientific and commercial information in designation of critical habitat. In addition, there have been substantial changes in policy and court interpretations of critical habitat that require consideration of areas not included in the 1994 designations. The 1994 final rule recognized the need to add areas to the critical habitat designation. For the above reasons this alternative was not considered to be viable and will not be analyzed further.

2.3 Designation of Additional Areas. This alternative was removed from further consideration because no additional areas that meet the definition of critical habitat have been identified which do not also conflict with Secretarial Order 3206. Secretarial Order 3206 requires that critical habitat be designated on tribal lands only to the extent that voluntary tribal measures are not adequate to achieve the necessary conservation purpose. We have spoken with representatives of the White Mountain Apache, San Carlos Apache and Yavapai Apache Tribes, the three tribes with potential critical habitat for spikedace or

loach minnow on their reservations. However, we do not have information on which to base an assessment of whether voluntary tribal measures are adequate to achieve conservation of spikedace and loach minnow on tribal lands. In addition, the short time allowed by the court to complete this critical habitat designation precludes us from engaging in a level of consultation with the tribes on a government-to-government basis which would enable us to make this required determination.

Given the above, we are not now proposing critical habitat on the Fort Apache, San Carlos Apache, or Yavapai Apache Indian Reservations. However, critical habitat consideration has been given to Eagle Creek, and the Verde and White rivers on these reservations. We are soliciting information as to whether these areas should be designated as critical habitat and request discussions with the tribes as to whether their voluntary measures are adequate to conserve these species on tribal lands. Such information will be considered in determining which, if any, tribal land should be designated as critical habitat for spikedace or loach minnow.

2.4 Deletion of Portions of Critical Habitat. Within the analysis of the proposed designation of critical habitat, the Service reviewed whether any discrete portions of river should be deleted from the final designation. The Service believes the areas proposed are needed for the conservation of spikedace and loach minnow and that recovery of the species will require all of these areas. The proposed areas form seven geographic complexes that provide for survival and recovery of each distinct genetic lineage of spikedace and loach minnow within all major segments of the historic range, with the exception of the Agua Fria River subbasin. Omission of any complex would result in loss of distinct genetic and geographic components of the species. Deletions within a complex would undermine the value of the complex due to needs for size, connectivity, and habitat and community diversity. It is important to avoid fragmentation of the critical habitat within the complexes, unless unavoidable due to policy or statutory requirements such as Secretarial Order 3206. In addition, activities on segments excluded from critical habitat will affect both upstream and downstream portions of the critical habitat. Following physical modification, a river channel usually undergoes a series of upstream and downstream adjustments to accommodate the change (Leopold *et al.* 1964, Rosgen 1995). Therefore, exclusion of areas internal to the complexes will substantially decrease the value of the remainder of the complex for conservation of spikedace and loach minnow. No viable alternative deleting portions of the critical habitat has been identified.

2.5 Action Alternative: This, our Preferred Alternative, is to finalize the designation of critical habitat as described in the proposed rule in the Federal Register (December 10, 1999) no later than February 17, 2000. The critical habitat designation would include the 1,443 km (894 mi) of stream channels within the identified stream reaches indicated below and areas within these reaches potentially inundated by high flow events.

Both occupied and currently unoccupied areas are proposed as critical habitat for spikedace and loach minnow. In accordance with section 3(5)(A)(i) of the Act, areas outside the geographical area occupied by the species may meet the definition of critical habitat upon determination that they are essential for the conservation of the species. The proposed designation includes all presently known populations of spikedace and loach minnow except those on Tribal lands and Indian allotted lands.

Spikedace: Geographic Area of Critical Habitat

The following areas are proposed as critical habitat for spikedace (see the proposed rule for exact descriptions of boundaries). The proposed designation includes 1325 kilometers (822 miles) along portions of 26 streams; however, individual streams are not isolated, but are connected with others to form seven areas or "complexes." The complexes include those which presently support populations of spikedace as well as some presently unoccupied by spikedace but which are considered essential for reestablishing populations of spikedace to achieve recovery. Distances and conversions are approximate.

1. Verde River complex, Yavapai County, Arizona. The Verde River is presently occupied by spikedace. Its tributary streams are believed to be presently unoccupied by spikedace. The Verde complex is unusual in the relatively stable thermal and hydrologic regime found in the upper river and in Fossil Creek, and spikedace in the Verde River are genetically (Tibbets 1993) and morphologically (Anderson and Hendrickson 1994) distinct from all other spikedace populations.

a. Verde River 171 km (94 mi) of river extending from the confluence with Fossil Creek upstream to Sullivan Dam, but excluding lands belonging to the Yavapai Apache Tribe. Sullivan Dam is at the upstream limit of perennial flow in the mainstem Verde River. Perennial flow results from a series of river-channel springs and from Granite Creek. Below Fossil Creek the Verde River becomes larger due to the input of Fossil Creek and changes character to an extent which may not provide substantial suitable habitat for spikedace.

b. Fossil Creek 8 km (5 mi) of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary. The lower portion of Fossil Creek contains all elements of spikedace habitat at present, except sufficient discharge. Discharge is currently diverted for hydropower generation at the Childs/Irving Hydropower site. Relicensing of the Childs/Irving Hydropower project will provide enhanced flows into lower Fossil Creek, although the amount of that flow restoration is still under negotiation.

c. West Clear Creek 12 km (7 mi) of creek extending from the confluence with the Verde River upstream to the confluence with Black Mountain Canyon. The lower portion of West Clear Creek was historically known to support spikedace and contains suitable,

although degraded, habitat. Gradient and channel morphology changes above Black Mountain Canyon make the upstream area not suitable for spikedace.

d. Beaver/Wet Beaver Creek 33 km (21 mi) of creek extending from the confluence with the Verde River upstream to the confluence with Casner Canyon. Beaver Creek, and its upstream extension in Wet Beaver Creek, historically supported spikedace and contain suitable, although degraded, habitat. Above Casner Canyon gradient and channel morphology changes make the stream unsuitable for spikedace.

e. Oak Creek 54 km (34 mi) of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary (near the Yavapai/Coconino County boundary). The lower portion of Oak Creek is part of the historical range of spikedace and contains suitable, although degraded, habitat. Above the unnamed tributary the creek becomes unsuitable due to urban and suburban development and to increasing gradient and substrate size.

f. Granite Creek 2.3 km (1.4 mi) of creek extending from the confluence with the Verde River upstream to a spring. As a perennial tributary of the upper Verde River, Granite Creek is considered an important expansion area for spikedace recovery.

2. Black River complex, Apache and Greenlee counties, Arizona. The Salt River subbasin is a significant portion of spikedace historical range and has no existing population of spikedace. Large areas of the subbasin are unsuitable, either because of topography or because of reservoirs, stream channel alteration by humans, or overwhelming nonnative species populations. Recovery planning for spikedace envisions reestablishing populations in the subbasin. The East and West Forks Black River contain suitable habitat and the continuing presence of loach minnow in the East Fork is evidence that it may support reestablishment of spikedace, which historically occurred with loach minnow in most streams in the Gila River basin. The following are some of the most suitable areas for reestablishment of spikedace.

a. East Fork Black River 8 km (5 mi) of river extending from the confluence with the West Fork Black River upstream to the confluence with Deer Creek.

b. North Fork of the East Fork Black River 18 km (11 mi) of river extending from the confluence with Deer Creek upstream to the confluence with Boneyard Creek.

c. West Fork Black River 10 km (6 mi) of river extending from the confluence with the East Fork Black River upstream to the confluence with Hay Creek. Above Hay Creek the gradient and channel morphology are unsuitable for spikedace.

3. Tonto Creek complex, Gila County, Arizona. Tonto Creek was historically occupied by spikedace and loach minnow. Suitable habitat still exists, although degradation has occurred due to watershed uses, water diversion, agriculture, roads, and nonnative species introduction.

The presence of substantial areas of Forest Service lands make this one of the most promising areas for reestablishment of spikedace in the Salt River subbasin.

a. Tonto Creek 47 km (29 mi) of creek extending from the confluence with Greenback Creek upstream to the confluence with Houston Creek. The influence of Roosevelt Lake below Greenback Creek, and gradient and substrate changes above Houston Creek, make the stream unsuitable for spikedace.

b. Greenback Creek 14 km (8 mi) of creek extending from the confluence with Tonto Creek upstream to Lime Springs.

c. Rye Creek 2.1 km (1.3 mi) of creek extending from the confluence with Tonto Creek upstream to the confluence with Brady Canyon. This area of Rye Creek still supports a native fish community indicating high potential for spikedace reestablishment.

4. Middle Gila/Lower San Pedro/Aravaipa Creek complex, Pinal and Graham counties, Arizona. This complex is occupied by spikedace with its population status ranging from rare to common. Aravaipa Creek supports one of the best, and most protected spikedace populations due to special use designations on lands of the Bureau of land Management and to substantial ownership by The Nature Conservancy as well as planned construction of fish barriers to invasion of nonnative fish. Enhancement of downstream habitats in the San Pedro and Gila rivers would contribute substantially to recovery of this species.

a. Gila River 63 km (39 mi) of river extending from Ashurst-Hayden Dam upstream to the confluence with the San Pedro River. A small population of spikedace presently occupies this area. At Ashurst-Hayden dam, all water is diverted into a canal. Above the confluence with the San Pedro River, flow in the Gila River is highly regulated by San Carlos Dam and becomes marginally suitable for spikedace.

b. San Pedro River 21 km (13 mi) of river extending from the confluence with the Gila River upstream to the confluence with Aravaipa Creek. This area is presently occupied by spikedace. Existing flow in the river comes primarily from surface and subsurface contributions from Aravaipa Creek.

c. Aravaipa Creek 45 km (28 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Stowe Gulch. Aravaipa Creek supports a substantial population of spikedace. Stowe Gulch is the upstream limit of sufficient perennial flow for spikedace.

5. Middle-Upper San Pedro River complex, Cochise, Graham, and Pima counties, Arizona. None of the habitat in this complex is presently occupied by spikedace. However, the San Pedro River is the type locality of spikedace and this complex contains important restoration area.

a. San Pedro River 74 km (46 mi) of river extending from the confluence with Alder Wash (near Redfield) upstream to the confluence with Ash Creek (near the Narrows). This middle portion of the river has increasing surface flow due to restoration activities, primarily groundwater pumping reductions.

b. Redfield Canyon 22 km (14 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Sycamore Canyon. Above Sycamore Canyon perennial water becomes too scarce and the habitat becomes unsuitable.

c. Hot Springs Canyon 19 km (12 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Bass Canyon. Hot Springs Canyon is presently unoccupied but contains suitable habitat for restoration of spikedace.

d. Bass Canyon 5 km (3 mi) of creek extending from the confluence with Hot Springs Canyon upstream to the confluence with Pine Canyon. Bass Canyon is an extension of the Hot Springs Canyon habitat.

e. San Pedro River 60 km (37 mi) of river extending from the confluence with the Babocomari River upstream to the US/Mexico border. Although presently unoccupied, this area is identified in Bureau of Land Management (BLM) (U.S. BLM 1993) planning documents as a high-potential restoration area for spikedace.

6. Gila Box/San Francisco River complex, Graham and Greenlee counties, Arizona and Catron County, New Mexico. The only spikedace population remaining in the complex is in Eagle Creek. Substantial restoration potential for spikedace exists in the remainder of the complex. This complex has the largest area of habitat suitable for spikedace restoration. In addition, management in the Gila Box, Bonita Creek, and the Blue River are highly compatible with recovery goals, giving restoration of spikedace in this complex a high likelihood of success.

a. Gila River 36 km (23 mi) of river extending from the Brown Canal diversion, at the head of the Safford Valley, upstream to the confluence with Owl Canyon, at the upper end of the Gila Box. The Gila Box is not known to presently support spikedace, but is considered to have a high potential for restoration of the species. Both above and below the Gila Box, the Gila River is highly modified by agriculture, diversions, and urban development.

b. Bonita Creek 19 km (12 mi) of creek extending from the confluence with the Gila River upstream to the confluence with Martinez Wash. Bonita Creek has no spikedace at present, but has suitable habitat. Bonita Creek above Martinez Wash lies on the San Carlos Apache Reservation, which is not included in this proposed designation.

c. Eagle Creek 74 km (46 mi) of creek extending from the Phelps-Dodge diversion dam upstream to the confluence of Dry Prong and East Eagle creeks, but excluding lands of the San Carlos Apache Reservation. Because the creek repeatedly flows from private or Forest Service land into the San Carlos Reservation and back, it is difficult to separately calculate stream milage on tribal lands. Therefore, the above milage covers the entire stream segment and is not corrected for tribal exclusions. Eagle Creek supports a small population of spikedace. Below the diversion dam the creek is often dry.

d. San Francisco River 182 km (113 mi) of river extending from the confluence with the Gila River upstream to the confluence with the Tularosa River. Habitat above the Tularosa River does not appear suitable for spikedace. The San Francisco River was historically occupied by spikedace, and is important recovery habitat for restoration of the species.

e. Blue River 82 km (51 mi) of river extending from the confluence with the San Francisco River upstream to the confluence of Campbell Blue and Dry Blue creeks. The Blue River is not presently occupied by spikedace, but planning is underway between several State and Federal agencies for restoration of native fishes in the Blue River.

f. Campbell Blue Creek 13 km (8 mi) of creek extending from the confluence of Dry Blue and Campbell Blue creeks upstream to the confluence with Coleman Canyon. Above Coleman Canyon the creek changes and becomes steeper and rockier, making it unsuitable for spikedace.

g. Little Blue Creek 5 km (3 mi) of creek extending from the confluence with the Blue River upstream to the mouth of a box canyon. Little Blue Creek is not presently occupied by spikedace, but contains suitable habitat and is considered an important restoration area for the species.

7. Upper Gila River complex, Grant and Catron Counties, New Mexico. This complex is occupied by spikedace and represents the largest remaining population. It is considered to represent the "core" of what remains of the species. Because of the remoteness of the area there is a relatively low degree of habitat threats.

a. Gila River 164 km (102 mi) of river extending from the confluence with Moore Canyon (near the Arizona/New Mexico border) upstream to the confluence of the East and West Forks. Below Moore Canyon, the river is substantially altered by agriculture, diversion, and urban development, thus making it unsuitable for spikedace.

b. East Fork Gila River 42 km (26 mi) of river extending from the confluence with the West Fork Gila River upstream to the confluence of Beaver and Taylor creeks.

c. Middle Fork Gila River 12 km (8 mi) of river extending from the confluence with the West Fork Gila River upstream to the confluence with Big Bear Canyon.

d. West Fork Gila River 12 km (8 mi) of river extending from the confluence with the East Fork Gila River upstream to the confluence with EE Canyon. This lower portion of the West Fork is occupied by spikedace, but the river becomes unsuitable for spikedace above EE Canyon due to gradient and channel morphology.

Loach Minnow: Geographic Area of Critical Habitat

The following areas are proposed as critical habitat for loach minnow (see the Regulation Promulgation section for exact descriptions of boundaries). The proposed designation includes 1,443 km (894 mi) along portions of 26 streams; however, individual streams are not isolated, but are connected with others to form 7 complexes. The complexes include those which presently support populations of loach minnow as well as some presently unoccupied by loach minnow but which are considered essential for reestablishing populations of loach minnow to achieve recovery. There is substantial overlap with the proposed critical habitat for spikedace; seven complexes and 26 streams are included in the proposed designation for both species. The distances and conversions below are approximate.

1. Verde River complex, Yavapai County, Arizona. Historically known from the Verde River and some of its tributaries, loach minnow is believed to be extirpated in this complex. The Verde complex is unusual in the relatively stable thermal and hydrologic regime found in the upper river and in Fossil Creek. The continuing presence of spikedace and the existence of suitable habitat create a high potential for restoration of loach minnow to the Verde system.

a. Verde River 171 km (106 mi) of river extending from the confluence with Fossil Creek upstream to Sullivan Dam, but excluding lands belonging to the Yavapai Apache Tribe. Sullivan Dam is at the upstream limit of perennial flow in the mainstem Verde River. Perennial flow results from a series of river-channel springs and from Granite Creek. Below Fossil Creek the Verde River becomes larger due to the input of Fossil Creek and changes character to an extent that it may not provide substantial suitable habitat for loach minnow.

b. Fossil Creek 8 km (5 mi) of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary. The lower portion of Fossil Creek contains all elements of loach minnow habitat at present, except sufficient discharge. Discharge is currently diverted for hydropower generation at the Childs/Irving Hydropower site. Relicensing of the Childs/Irving Hydropower project will provide enhanced flows into lower Fossil Creek, although the amount of that flow restoration is still under negotiation.

c. West Clear Creek 12 km (7 mi) of creek extending from the confluence with the Verde River upstream to the confluence with Black Mountain Canyon. The lower portion of West Clear Creek contains suitable, although degraded, habitat for loach minnow. Gradient and channel morphology changes above Black Mountain Canyon make the upstream area unsuitable for loach minnow.

d. Beaver/Wet Beaver Creek 33 km (21 mi) of creek extending from the confluence with the Verde River upstream to the confluence with Casner Canyon. Beaver Creek, and its upstream extension in Wet Beaver Creek, historically supported loach minnow and contain suitable, although degraded, habitat. Above Casner Canyon gradient and channel morphology changes make the stream unsuitable for loach minnow.

e. Oak Creek 54 km (34 mi) of creek extending from the confluence with the Verde River upstream to the confluence with an unnamed tributary (near the Yavapai/Coconino County boundary). The lower portion contains suitable, although degraded, habitat, for loach minnow. Above the unnamed tributary the creek becomes unsuitable due to urban and suburban development and to increasing gradient and substrate size.

f. Granite Creek 2.3 km (1.4 mi) of creek extending from the confluence with the Verde River upstream to a spring. Below the spring, which supplies much of the base flow of Granite Creek, there is suitable habitat for loach minnow.

2. Black River complex, Apache and Greenlee counties, Arizona. The Salt River subbasin is a significant portion of loach minnow historical range, but loach minnow have been extirpated from all but a small portion in the Black and White rivers. As the only remaining population of loach minnow on public lands in the Salt River basin, the Black River complex is considered vital to survival and recovery of the species.

a. East Fork Black River 8 km (5 mi) of river extending from the confluence with the West Fork Black River upstream to the confluence with Deer Creek. This area is occupied by loach minnow, although the downstream end of the population is not well known. This population was only discovered in 1996.

b. North Fork of the East Fork Black River 18 km (11 mi) of river extending from the confluence with Deer Creek upstream to the confluence with Boneyard Creek. This area is occupied by loach minnow, although the upstream portion of the population is not well known. Above Boneyard Creek, the river character makes it unsuitable for loach minnow.

c. Boneyard Creek 2.3 km (1.4 mi) of creek extending from the confluence with the East Fork Black River upstream to the confluence with an unnamed tributary. Although no loach minnow have been found in Boneyard Creek, they are probably present based on the

pattern of occupation of lower portions of small tributaries in other parts of the loach minnow range.

d. Coyote Creek 3 km (2 mi) of creek extending from the confluence with the East Fork Black River upstream to the confluence with an unnamed tributary. Loach minnow are thought to use the lower portion of this creek as part of the population in the East Fork Black River.

e. West Fork Black River 10 km (6 mi) of river extending from the confluence with the East Fork Black River upstream to the confluence with Hay Creek. Above Hay Creek the gradient and channel morphology are unsuitable for loach minnow. The West Fork Black River is not known to be occupied by loach minnow at present. However, it is considered important for conservation of the Black River remnant of the Salt River subbasin population.

3. Tonto Creek complex, Gila County, Arizona. Tonto Creek was historically occupied by spikedace and loach minnow. Suitable habitat still exists, although degradation has occurred due to watershed uses, water diversion, agriculture, roads, and nonnative species introduction. The presence of substantial areas of Forest Service lands make this one of the most promising areas for reestablishment of loach minnow in the Salt River subbasin.

a. Tonto Creek 70 km (44 mi) of creek extending from the confluence with Greenback Creek upstream to the confluence with Haigler Creek. The influence of Roosevelt Lake above Greenback Creek and changes in channel morphology above Haigler Creek make those portions of the stream unsuitable for loach minnow.

b. Greenback Creek 14 km (8 mi) of creek extending from the confluence with Tonto Creek upstream to Lime Springs.

c. Rye Creek 2.1 km (1.3 mi) of creek extending from the confluence with Tonto Creek upstream to the confluence with Brady Canyon. This area of Rye Creek still supports a native fish community indicating high potential for loach minnow reestablishment.

4. Middle Gila/Lower San Pedro/Aravaipa Creek complex, Pinal and Graham counties, Arizona. This complex presently has loach minnow only in Aravaipa Creek and its tributaries. Aravaipa Creek supports one of the best, and most protected spikedace populations due to special use designations on lands of the Bureau of land Management and to substantial ownership by The Nature Conservancy as well as planned construction of fish barriers to invasion of nonnative fish. Enhancement of downstream habitats and expansion of the Aravaipa Creek population into the San Pedro and Gila rivers would contribute substantially to recovery of this species. Expansion of this population is important to recovery of the species.

a. Gila River 63 km (39 mi) of river extending from Ashurst-Hayden Dam upstream to the confluence with the San Pedro River. At Ashurst-Hayden Dam, all water is diverted into a canal. Above the confluence with the San Pedro River, flow in the Gila River is highly regulated by San Carlos Dam and becomes marginally suitable for loach minnow.

b. San Pedro River 21 km (13 mi) of river extending from the confluence with the Gila River upstream to the confluence with Aravaipa Creek. This is an important connection between the existing population of loach minnow in Aravaipa Creek and the recovery habitat in the Gila River. Existing flow in the river comes primarily from surface and subsurface contributions from Aravaipa Creek.

c. Aravaipa Creek 45 km (28 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Stowe Gulch. Aravaipa Creek supports a substantial population of loach minnow. Stowe Gulch is the upstream limit of sufficient perennial flow for loach minnow.

d. Turkey Creek 4 km (3 mi) of creek extending from the confluence with Aravaipa Creek upstream to the confluence with Oak Grove Canyon. This creek is occupied by loach minnow. A substantial portion of the flow in Turkey Creek comes from the tributary Oak Grove Canyon.

e. Deer Creek 4 km (3 mi) of creek extending from the confluence with Aravaipa Creek upstream to the boundary of the Aravaipa Wilderness. This stream is occupied by loach minnow. Suitable habitat extends to the Wilderness boundary.

5. Middle-Upper San Pedro River complex, Cochise, Graham, and Pima counties, Arizona. None of the habitat in this complex is presently occupied by loach minnow. However, the San Pedro River is the type locality of loach minnow and this complex contains important restoration areas.

a. San Pedro River 74 km (46 mi) of river extending from the confluence with Alder Wash (near Redfield) upstream to the confluence with Ash Creek (near the Narrows). This middle portion of the river has increasing surface flow due to restoration activities, primarily groundwater pumping reductions.

b. Redfield Canyon 22 km (14 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Sycamore Canyon. Above Sycamore Canyon perennial water becomes too scarce and the habitat becomes unsuitable.

c. Hot Springs Canyon 20 km (12 mi) of creek extending from the confluence with the San Pedro River upstream to the confluence with Bass Canyon. Hot Springs Canyon contains suitable habitat for restoration of loach minnow.

d. Bass Canyon 5 km (3 mi) of creek extending from the confluence with Hot Springs Canyon upstream to the confluence with Pine Canyon. Bass Canyon is an extension of the Hot Springs Canyon habitat.

e. San Pedro River 60 km (37 mi) of river extending from the confluence with the Babocomari River upstream to the US/Mexico border. Although presently unoccupied, this area is identified in BLM planning documents (U.S. BLM 1993) as high potential restoration area for loach minnow.

6. Gila Box /San Francisco River complex, Graham and Greenlee counties, Arizona and Catron County, New Mexico. Most of this complex is occupied by loach minnow, although the status varies substantially from one portion to another. Only Bonita Creek, Little Blue Creek, and the Gila River are presently unoccupied. The Blue River system and adjacent portions of the San Francisco River is the longest stretch of occupied loach minnow habitat unbroken by large areas of unsuitable habitat. Management in the Gila Box, Bonita Creek, and the Blue River are highly compatible with recovery goals, giving restoration of loach minnow in this complex a high likelihood of success.

a. Gila River 36 km (23 mi) of river extending from the Brown Canal diversion, at the head of the Safford Valley, upstream to the confluence with Owl Canyon, at the upper end of the Gila Box. The Gila Box is considered to have a high potential for restoration of loach minnow and populations are located shortly upstream in both Eagle Creek and the San Francisco River. Both above and below the Gila Box, the Gila River is highly modified by agriculture, diversions, and urban development.

b. Bonita Creek 36 km (23 mi) of creek extending from the confluence with the Gila River upstream to the confluence with Martinez Wash. Suitable habitat for loach minnow exists in Bonita Creek. Bonita Creek above Martinez Wash lies on the San Carlos Apache Reservation, which is excluded from this proposed designation.

c. Eagle Creek 74 km (46 mi) of creek extending from the Phelps-Dodge diversion dam upstream to the confluence of Dry Prong and East Eagle creeks, but excluding lands of the San Carlos Apache Reservation. Because the creek repeatedly flows from private or Forest Service land into the San Carlos Reservation and back, it is difficult to separately calculate stream milage on tribal lands. Therefore, the above milage covers the entire stream segment and is not corrected for tribal exclusions. Below the diversion dam the creek is often dry.

d. San Francisco River 203 km (126 mi) of river extending from the confluence with the Gila River upstream to the mouth of The Box, a canyon above the town of Reserve. Loach minnow in the San Francisco River vary substantially throughout the length of the river, from common to rare.

e. Tularosa River 30 km (19 mi) of river extending from the confluence with the San Francisco River upstream to the town of Cruzville. Above Cruzville the habitat becomes unsuitable.

f. Negrito Creek 7 km (4 mi) of creek extending from the confluence with the San Francisco River upstream to the confluence with Cerco Canyon. Above this area, gradient and channel morphology make the creek unsuitable for loach minnow.

g. Whitewater Creek 2 km (1 mi) of creek extending from the confluence with the San Francisco River upstream to the confluence with Little Whitewater Creek. Upstream gradient and channel changes make it unsuitable for loach minnow.

h. Blue River 82 km (51 mi) of river extending from the confluence with the San Francisco River upstream to the confluence of Campbell Blue and Dry Blue creeks. Planning is underway between several State and Federal agencies to do significant restoration of native fishes in the Blue River.

i. Campbell Blue Creek 13 km (8 mi) of creek extending from the confluence of Dry Blue and Campbell Blue creeks upstream to the confluence with Coleman Canyon. Above Coleman Canyon the creek changes and becomes steeper and rockier, making it unsuitable for loach minnow.

j. Dry Blue Creek 5 km (3 mi) of creek extending from the confluence with Campbell Blue Creek upstream to the confluence with Pace Creek.

k. Pace Creek 1.2 km (0.8 mi) of creek extending from the confluence with Dry Blue Creek upstream to a barrier falls.

l. Frieborn Creek 1.8 km (1.1 mi) of creek extending from the confluence with Dry Blue Creek upstream to an unnamed tributary.

m. Little Blue Creek 5 km (3 mi) of creek extending from the confluence with the Blue River upstream to the mouth of a box canyon. Little Blue Creek is not presently occupied by loach minnow, but contains suitable habitat and is considered an important restoration area for the species.

7. Upper Gila River complex, Grant and Catron Counties, New Mexico. This complex is occupied by loach minnow throughout. It is considered to represent the "core" of what remains of the species. Because of the remoteness of the area there is a relatively low degree of habitat threats.

a. Gila River 164 km (102 mi) of river extending from the confluence with Moore Canyon (near the Arizona/New Mexico border) upstream to the confluence of the East

and West Forks. Below Moore Canyon, the river is substantially altered by agriculture, diversion, and urban development, thus making it unsuitable for loach minnow.

b. East Fork Gila River 42 km (26 mi) of river extending from the confluence with the West Fork Gila River upstream to the confluence of Beaver and Taylor creeks.

c. Middle Fork Gila River 19 km (12 mi) of river extending from the confluence with the West Fork Gila River upstream to the confluence with Brothers West Canyon.

d. West Fork Gila River 12 km (8 mi) of river extending from the confluence with the East Fork Gila River upstream to the confluence with EE Canyon. This lower portion of the West Fork is occupied by loach minnow, but the river becomes unsuitable above EE Canyon due to gradient and channel morphology.

Spikedace - Primary Constituent Elements of Critical Habitat

The primary constituent elements for spikedace were determined from studies on their habitat requirements and population biology including, but not limited to, Barber *et al.* 1970; Minckley 1973; Anderson 1978; Barber and Minckley 1983; Turner and Taffanelli 1983; Barrett *et al.* 1985; Propst *et al.* 1986; U.S. Fish and Wildlife Service 1989; Hardy *et al.* 1990; Douglas *et al.* 1994; Stefferud and Rinne 1996; Velasco 1997. These primary constituent elements include:

- permanent, flowing, unpolluted water;
- living areas for adult spikedace with slow to swift flow velocities in shallow water with shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand/gravel bars, and eddies at downstream riffle edges;
- living areas for juveniles with slow to moderate water velocities in shallow water with moderate amounts of instream cover;
- living areas for the larval stage with slow to moderate flow velocities in shallow water with abundant instream cover;
- sand, gravel, and cobble substrates with low to moderate amounts of fine sediment and substrate embeddedness;
- pool, riffle, run, and backwater components of the streams;
- low stream gradient;
- water temperatures in the approximate range of 1 - 30° C (35-85° F) with natural diurnal and seasonal variation;
- abundant aquatic insect food base;
- periodic natural flooding;
- a natural, unregulated hydrograph, or if flows are modified or regulated, then a hydrograph that demonstrates an ability to support a native fish community; and
- few or no predatory or competitive nonnative species present.

The areas being proposed for designation as critical habitat for spikedace provide the above primary constituent elements or will be capable, with restoration, of providing them. All of

the proposed areas require special management considerations or protection to ensure their contribution to the species recovery.

Loach minnow - Primary Constituent Elements of Critical Habitat

The primary constituent elements for loach minnow were determined from studies on their habitat requirements and population biology including, but not limited to, Barber and Minckley 1966; Minckley 1973; Schreiber 1978; Britt 1982; Turner and Taffanelli 1983; U.S. Fish and Wildlife Service 1988; Rinne 1989; Hardy *et al.* 1990; Vives and Minckley 1990; Propst and Bestgen 1991; Douglas *et al*. 1994; Velasco 1997. These primary constituent elements include:

- permanent flowing, unpolluted water;
- living areas for adults with moderate to swift flow velocities in shallow water with gravel, cobble, and rubble substrates;
- living areas for juveniles with moderate to swift flow velocities in shallow water with sand, gravel, cobble, and rubble substrates;
- living areas for larval loach minnow with slow to moderate velocities in shallow water with sand, gravel, and cobble substrates and abundant instream cover;
- spawning areas with slow to swift flow velocities in shallow water with uncemented cobble and rubble substrate;
- low amounts of fine sediment and substrate embeddedness;
- riffle, run, and backwater components present in the aquatic habitat;
- low to moderate stream gradient;
- water temperatures in the approximate range of 1-30° C (35-85° F) with natural diurnal and seasonal variation;
- abundant aquatic insect food base;
- periodic natural flooding;
- a natural, unregulated hydrograph, or if flows are modified or regulated, then a hydrograph that demonstrates a retained ability to support a native fish community; and
- few or no predatory or competitive nonnative species present.

The areas being proposed for designation as critical habitat for loach minnow provide the above primary constituent elements or will be capable, with restoration, of providing them. All of the proposed areas require special management considerations or protection to ensure their contribution to the species recovery.

3.0 Description of the Affected Environment

3.1 Physical Environment

The Gila River basin encompasses approximately 160,000 square kilometers (60,000 square miles) in the southwestern portion of New Mexico and the southern half of Arizona. The Gila

River begins along the continental divide and flows in a southwesterly direction to enter the Colorado River near the U.S. border with Mexico. There are a number of major tributaries (subbasins) including the San Francisco, Salt, Verde, San Simon, San Pedro, Santa Cruz, Agua Fria and Hassayampa. Along its length the Gila River and its tributaries flow from subalpine coniferous forests to Sonoran desert scrub (Brown 1994). Rainfall varies greatly from the upper portion of the basin to the lower, but the area is in general hot and arid with a biseasonal (winter-summer) precipitation pattern. Hydrograph patterns in the upper reaches reflect snowmelt, but the overall pattern for the basin is based on precipitation events. Stream flow is flashy and the two-year flood event is usually over an order of magnitude greater than the base flow.

Geology and topography varies greatly along the stream reaches proposed for critical habitat designation for spikedace and loach minnow. All of the reaches proposed include canyon areas as well as valleys with broad floodplains. Primary unifying factors are low gradient and moderate sized substrate. Stream flows (discharge) vary from very small in tributaries such as Pace Creek in the upper Blue River subbasin, to moderate in the middle Gila River with a mean discharge of 15 cubic meters per second (538 cubic feet per second).

3.2 Biological Environment

Riparian vegetation along the streams proposed for designation is primarily cottonwood (*Populus fremontii* and *angustifolia*) and willow (*Salix* sp.). At higher elevations there is also extensive alder (*Alnus oblongifolia*) and boxelder (*Acer negundo*), at middle elevations sycamore (*Platanus wrightii*), velvet ash (*Fraxinus pennsylvanica*), and walnut (*Juglans major*) are major components, and at lower elevations mesquite (*Prosopis juliflora*), seepwillow (*Baccharis* sp.), and hackberry (*Celtis reticulata*) are prominent.

The native fish community is an important component of the biological environment of the areas proposed for critical habitat designation. While the native fish fauna of the Gila River basin originally included 17 species, one of those is extinct and several have become extirpated from the basin. Remaining or reestablished native species in the areas proposed for designation range from two to eight and include spikedace, loach minnow, desert sucker (*Pantosteus [Catostomus] clarki*), Sonora sucker (*Catostomus insignis*), razorback sucker (*Xyrauchen texanus*), roundtail chub (*Gila robusta*), speckled dace (*Rhinichthys osculus*), and longfin dace (*Agosia chrysogaster*).

There are a number of other endangered and threatened species in the areas proposed for critical habitat designation for spikedace and loach minnow. The endangered razorback sucker has been stocked into the Gila Box, lower San Francisco River, Blue and Verde rivers, and Eagle and Bonita creeks. Critical habitat for razorback sucker includes the Gila River and its 100-year floodplain from the Arizona/New Mexico border downstream to San Carlos Lake, including the Gila Box, which is part of this proposed designation. It also includes the Verde River and its 100-year floodplain from Perkinsville to Horseshoe Reservoir. The endangered Colorado squawfish

(*Ptychocheilus lucius*) has also been stocked into the Verde River, but as an experimental nonessential population.

The endangered southwestern willow flycatcher (*Empidonax traillii extimus*) is found in many areas of the proposed critical habitat for spikedace and loach minnow. Critical habitat for the flycatcher includes the San Pedro River from the Hereford Bridge to Benson and from Aguaja Canyon to the Gila River, a substantial overlap with the proposed designation for spikedace and loach minnow. Southwestern willow flycatcher critical habitat also includes other areas of the proposed spikedace and loach minnow critical habitat, including the Verde River from the upper end of the Verde Valley to Horseshoe Reservoir, the lower portions of Beaver and West Clear creeks, the upper Gila River in the Cliff/Gila Valley, the East and West Forks of the Gila River, the upper Gila mainstem just below the Forks, and the San Francisco River from Frisco Hot Springs upstream to near the town of Luna, and the Tularosa River.

The endangered Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*) is found along the upper San Pedro River and has designated critical habitat from the Hereford Bridge to Benson, overlapping substantially with the proposed critical habitat designation for spikedace and loach minnow. The endangered cactus ferruginous pygmy-owl (*Glaucidium brasilianum cactorum*) inhabits the riparian areas along the San Pedro and middle Gila rivers. Critical habitat for the pygmy-owl is designated on the San Pedro River from Roble Canyon to the confluence with the Gila River and on the Gila River from the confluence with the San Pedro River to Florence.

The threatened bald eagle (*Haliaeetus leucocephalus*) nests along the Verde River and Tonto Creek, on the middle Gila River, and on the uppermost San Francisco River. Wintering bald eagles use most of the streams included in the proposed critical habitat designation for spikedace and loach minnow.

3.3 Human Environment

There is a wide diversity of human activities and land and water uses throughout the areas proposed for critical habitat designation. On the upper Gila, Verde, Blue, San Francisco, Tularosa, and Black rivers and their tributaries and Eagle and Tonto creeks, the predominant land ownership is National Forest. Uses of National Forest lands include timber harvest, grazing, recreation, roads, mining, and other activities. On the San Pedro and middle Gila rivers, and Aravaipa and Bonita Creek, the Bureau of Land Management is a primary manager. Livestock grazing, recreation, roads, and mining are major uses of those lands. On both National Forest and Bureau of Land Management managed lands there are also a number of special use areas designated that offer some level of protection to the streams from adverse impacts of human use. These include the Gila, Aravaipa, and Hellsgate Wildernesses, Blue Range Primitive Area, and Gila Box and San Pedro Riparian National Conservation Areas.

Private lands are scattered throughout the proposed designation with large areas of private land in the Cliff/Gila Valley on the upper Gila River, the Verde Valley on the Verde River, and the middle and lower San Pedro River. Uses on the private lands are primarily agricultural, including livestock grazing, pasture, and irrigated cropland. Significant numbers of irrigation diversions exists in these areas. In the Verde Valley and upper San Pedro there is extensive urban and suburban development along the river. Small towns and small-lot residential and summer-home development exists in many other areas. Significant areas of land are owned by large mining companies, such as Phelps-Dodge Corporation and ASARCO, with concentrations in the Cliff-Gila Valley, the lower San Francisco River and Eagle Creek, and in the Winkleman area on the lower San Pedro and middle Gila rivers. Some of these lands are presently used for agriculture and water rights and others are used for large open-pit mining, milling, and tailings disposal. The Nature Conservancy also owns significant areas of land within the proposed designation, including on the upper Gila River, Aravaipa Creek, the San Pedro River, and the middle Verde River. The Nature Conservancy lands are managed for natural value with recreational use as a secondary activity.

Tribal lands exist in the vicinity of the proposed critical habitat designation, but are not being proposed as critical habitat. The White Mountain Apache Reservation lies downstream from the Black River areas included in the proposal, as does the San Carlos Apache Reservation. Because of its sinuous course along the Reservation boundary, the portion of Eagle Creek proposed for designation lies upstream, downstream, and across the stream from Reservation lands. These reservation areas are primarily used for livestock grazing, fuelwood cutting, roads, and recreation. The Yavapai-Apache Indian Community have lands along the Verde River where critical habitat is proposed both upstream and downstream. Some of these lands are used for commercial purposes. The Gila River Indian Community is downstream from the area proposed on the middle Gila River and receives irrigation water via diversion from the river. About 200 allottees hold a small area of land on lower Aravaipa Creek, where critical habitat is proposed. Those lands are presently used only by dispersed public recreation, with the exception of a fish barrier that is being built by the Bureau of Reclamation under the terms of a 1994 biological opinion on the potential for the Central Arizona Project to introduce and spread nonnative aquatic species. Other Reservations that are located in the general area include the Yavapai-Prescott Tribe, Mohave-Apache Indian Tribe (Fort McDowell), and the Salt River Pima-Maricopa Indian Community. None of these have lands that will be affected by the designation.

Archaeological and historical resources are located throughout the area proposed for designation as critical habitat for spikedace and loach minnow. Notable areas are the Gila Cliff Dwellings National Monument on the West Fork Gila River, Tuzigoot National Monument on the Verde River, and Montezuma's Castle National Monument on Beaver Creek. However, there are numerous small sites scattered along most of the streams.

Water development and diversion occurs on lands of all ownership. Large water development is unusual in any of the proposed areas because such development often precludes habitat for spikedace and loach minnow. The one exception is the middle Gila River below Coolidge Dam

(San Carlos Lake). Although flow in this portion of the river is regulated by Coolidge Dam releases, the river still retains spikedace, presumable due to the ameliorating influence of the unregulated hydrograph of the San Pedro River, which is a major contributor to flows in this reach. There are other major impoundments downstream from the proposed critical habitat, but their adverse impacts are less than from upstream impoundments. Numerous small impoundments exist, such as Sullivan Lake on the upper Verde, which is a small mainstem stock tank located above the beginning of perennial flow in the Verde River and Wall Lake, a small recreational fishing reservoir on the upper East Fork Gila River. Irrigation diversions are located throughout the proposed critical habitat designation. Many, such as the diversions in the Verde Valley, the Phelps-Dodge diversion of Eagle Creek, the City of Safford diversion in Bonita Creek, the private hatchery diversion on the upper Blue River, and the diversions in the Pleasanton-Glenwood area on the San Francisco River, divert all stream flow completely during some seasons. Groundwater pumping is also a major threat to the surface flow of several of the rivers. In the San Pedro River, groundwater pumping in the Sierra Vista area is expected to completely remove surface flow in the river unless significant reduction in the existing cone of depression can be achieved (Rojo 1998) and groundwater pumping is a serious threat to surface flows in the upper and middle Verde rivers (Arizona Department of Water Resources 1994, Ewing *et al*. 1994).

4.0 Environmental Consequences

This section reviews the environmental consequences of designating critical habitat for spikedace and loach minnow under the proposed alternative and the environmental consequences of the no action alternative. The United States District Court for the District of New Mexico has ordered the Secretary of the Interior to issue a final critical habitat designation for spikedace and loach minnow by February 17, 1999.

Regardless of which alternative is chosen, Federal agencies are required to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of the listed species, or destroy or adversely modify designated critical habitat in accordance with section 7(a)(2) of the Act. Activities that adversely modify critical habitat are defined as those actions that "appreciably diminish the value of critical habitat for both the survival and recovery" of the species (50 CFR 401.02). Activities that jeopardize a species are defined as those actions that "reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery" of the listed species (50 CFR 402.02). According to these definitions, activities that destroy or adversely modify critical habitat would ordinarily jeopardize the species. Therefore, designation of critical habitat has very rarely resulted in greater protection than that afforded under section 7 by the listing of a species. Section 7 consultations apply only to actions with Federal involvement (i.e., activities authorized, funded or conducted by Federal agencies), and do not affect activities strictly under State or private authority.

As required by NEPA, this document is in part intended to disclose the programmatic goals and objectives of the Act. These objectives include the protection of natural communities and ecosystems, the minimization of fragmentation and the promotion of the natural patterns and

connectivity of wildlife habitats, the promotion of native species and the avoidance of the introduction of non-native species, the protection of rare and ecologically important species and unique or sensitive environments, the maintenance of naturally occurring ecosystem processes and genetic and structural diversity, and the restoration of ecosystems, communities and the recovery of species.

A designation of critical habitat may in some cases provide some benefits to a species in that the designation may be helpful in alerting Federal agencies to situations when section 7 consultation is required. This may be particularly true in cases where the action would not result in direct mortality, injury or harm to individuals of a listed species (e.g., an action occurring within a critical habitat area when a species is not present). Another potential benefit is that critical habitat may help to focus Federal, State, and private conservation and management efforts. In practice, however, the designation of critical habitat for spikedace and loach minnow will effectively provide no additional benefits to the species because there are functioning program activities already alerting Federal agencies and the public of endangered species concerns. Since the two species were listed in 1986, there have been a number of consultations with the Forest Service, Corps, and Reclamation. No additional restrictions are expected to resulted from the proposed critical habitat in presently occupied areas. In areas which do not currently contain spikedace or loach minnow, critical habitat designation may have some effect in that it will require Federal agencies to consult with us pursuant to section 7 of the Act, and thus will require them to insure their actions do not destroy or adversely modify critical habitat.

4.1 No Critical Habitat Designation (No Action Alternative)

In addition to examining the environmental consequences that would result from not designating critical habitat, this alternative may be used as a baseline for comparison to the action alternative (the proposed alternative).

4.1.1 Effects on spikedace and loach minnow

As discussed in section 4.0 above, this alternative would have no significant impacts to spikedace or loach minnow in areas presently occupied by the species because the protections resulting from their listing in 1986 and the associated requirements of section 7 of the Act are already in place and are duplicative of protections associated with critical habitat designation. There may be some negative effect in unoccupied areas because the opportunity to avoid harm to the species habitat and assist in its recovery via the section 7 consultation process may not occur, if agencies are unaware of the need to consult on unoccupied areas.

4.1.2 Effect on Fish, Wildlife and Plants

As discussed in section 4.0 above, this alternative would have no significant impacts to Fish, Wildlife or Plants beyond those protections already in place as a result of listing of spikedace and loach minnow in 1986 and associated requirements of section 7 of the Act. There may be some negative effect in unoccupied areas because the opportunity to avoid harm to the species habitat

and assist in its recovery via the section 7 consultation process may not occur, if agencies are unaware of the need to consult on unoccupied areas.

4.1.3 Recreational Impacts

As discussed in section 4.0 above, this alternative would have no impacts upon the continued use of the Gila River basin for camping, fishing, and swimming beyond those impacts upon recreational use already resulting from the 1986 listing of spikedace and loach minnow.

4.1.4 Water Management Impacts

As discussed in section 4.0 above, this alternative would have no impacts upon activities such as irrigation, water diversions and impoundments, flood control, waste water management or hydroelectric activities beyond those impacts upon water management already resulting from the 1986 listing of spikedace and loach minnow and associated requirements of section 7 of the Act.

4.1.5 Agricultural, Including Timber, Fuelwood, and Grazing Impacts

As discussed in section 4.0 above, this alternative would have no impacts upon agricultural activities beyond those already resulting from the listing of the 1986 listing of spikedace and loach minnow and the associated requirements of section 7 of the Act.

4.1.6 Socioeconomic Impacts

As discussed in section 4.0 above, this alternative would have no impacts to the economic vitality of existing businesses within the area, business districts, the local economy, tax revenues, public expenditures, or municipalities beyond those impacts already resulting from the1986 listing of spikedace and loach minnow and the associated requirements of section 7 of the Act. This alternative would likewise have no social impacts in neighborhoods or on community cohesion.

4.2 Proposed Action

The proposed action is to finalize the designation of critical habitat as described in the proposed rule published in the Federal Register (December 10, 1999) no later than February 17, 2000 (as specified in the District Court order of September 20, 1999). Critical habitat would include the 1,443 kilometers (894 miles) of stream channels within the identified stream reaches indicated below and areas within these reaches potentially inundated by high flow events.

4.2.1 Effects on Spikedace and Loach Minnow

Designation of critical habitat is not anticipated to result in discernible effects to spikedace and loach minnow in areas presently occupied by the species beyond protections afforded by the species listing. The species listing ensures that Federal agencies cannot manipulate the habitat of

the species to the point that the continued existence of spikedace and loach minnow is jeopardized. This prohibition also applies to their habitats and constituent elements that are included within the critical habitat designation. There may be some beneficial effect in unoccupied areas because of the opportunity to avoid adverse impacts to the species habitat and assist in its recovery via the section 7 consultation process.

4.2.2 Effect on Fish, Wildlife and Plants

Designation of critical habitat in occupied areas is not anticipated to result in discernible effects on fish, wildlife, and plants beyond those protections resulting from the1986 listing of spikedace and loach minnow and associated requirements of section 7 of the Act. The effects of listing and critical habitat together are, at a minimum, anticipated to be a lessening of threats to spikedace and loach minnow, at the maximum, the effects of listing and critical habitat together are anticipated to be restored health to the river ecosystem with concomitant recovery of the fish. There may be some beneficial effect in unoccupied areas because of the opportunity to avoid adverse impacts to the habitat of co-occurring species via protection of spikedace and loach minnow habitat through the section 7 consultation process.

4.2.3 Recreational Impacts

This alternative may have impacts on the continued use of the Gila River basin for camping, fishing, and swimming beyond those impacts upon recreational use already resulting from the 1986 listing of spikedace and loach minnow and associated requirements of section 7 of the Act. We have reviewed the draft Economic Analysis addressing the effect of this action. Unfortunately, the court ordered deadline precludes us from completing our canvassing of Federal agencies for their assessment of the impact of critical habitat designation. This information should be available for the final environmental assessment. At this time, the best available information leads us to conclude that there will be recreational impacts beyond those already associated with the species listing, primarily in presently unoccupied areas proposed as critical habitat. These impacts may be positive, e.g., the protection and enhancement of recreational opportunities such as sport fishing, or negative, e.g., restrictions on some recreational activities which increase siltation in streams. Until further economic analyses are completed, we are unable to reliably estimate the impacts to recreation.

4.2.4 Water Management Impacts

Effects to water management within the project area were analyzed by comparing the conditions arising from the designation to those resulting from the No Action alternative. We have reviewed the draft Economic Analysis addressing the effect of this action. As with the recreation analysis, the court ordered deadline precludes us from completing our canvassing of Federal agencies for their assessment of the impact of critical habitat designation. This information should be available for the final environmental assessment. At this time, the best available information leads us to conclude that there will be water management impacts beyond those already associated with the

species listing, primarily in presently unoccupied areas proposed as critical habitat. However, until further economic analyses are completed, we are unable to reliably estimate those impacts.

4.2.5 Agricultural, Including Timber, Fuelwood, and Grazing Impacts

From a geographic perspective, the landscape surrounding the critical habitat for spikedace and loach minnow is predominantly nonmetropolitan. The possibility exists that private entities could be affected if Federal actions are modified by the designation of critical habitat. As with the recreation and water management analysis, the court ordered deadline precludes us from completing our canvassing of Federal agencies for their assessment of the impact of critical habitat designation. This information should be available for the final environmental assessment. At this time, the best available information leads us to conclude that there will be agricultural impacts beyond those already associated with the species listing, primarily in presently unoccupied areas proposed as critical habitat. However, until further economic analyses are completed, we are unable to reliably estimate those impacts.

4.2.6 Socioeconomic Impacts

Effects to the social infrastructures and economy of the project area will be analyzed by comparing the conditions arising from the designation to those resulting from the No Action alternative. Again, the court ordered deadline precludes us from completing our canvassing of Federal agencies for their assessment of the impact of critical habitat designation. This information should be available for the final environmental assessment. At this time, the best available information leads us to conclude that there will be agricultural impacts beyond those already associated with the species listing, primarily in presently unoccupied areas proposed as critical habitat. However, until further economic analyses are completed, we are unable to reliably estimate those impacts.

4.2.7 Direct and Indirect Effects

Designation of critical habitat in occupied areas is not anticipated to result in direct effects on the components, structures, and functioning of the Gila River ecosystem, or the aesthetic, historic, economic, social, and health resources of the area, beyond those effects resulting from the1986 listing of spikedace and loach minnow and associated requirements of section 7 of the Act. However, at this time, the best available information leads us to conclude that there will be direct impacts beyond those already associated with the species listing, in presently unoccupied areas proposed as critical habitat. As with other impacts discussed above, the court ordered deadline precludes us from completing our canvassing of Federal agencies for their assessment of the impact of critical habitat designation. This information should be available for the final environmental assessment. Until further economic analyses are completed, we are unable to reliably estimate those impacts.

Indirect effects of the designation that are reasonably foreseeable include focusing Federal, State, and private, conservation and management efforts, and alerting Federal agencies to situations requiring section 7 consultation. The possibility exists that private entities could be impacted if Federal actions are curtailed by the designation of critical habitat. Until we complete our survey we are unable to reliably estimate those impacts.

4.2.8 Cumulative Impact

Designation of critical habitat for spikedace and loach minnow in presently occupied areas will have no incremental impact when added to other past, present, and reasonably foreseeable future actions within the watersheds comprising the Gila River basin. Development of the basin over the past century has changed and continues to modify the historic character of the rivers. Most rivers in the basin are now controlled by dams and diverted and often depleted for irrigation and urban water supply.

In unoccupied areas there may be some impact on Federal or non-Federal actions. However, we expect this impact to be relatively small because in addition to spikedace and loach minnow, the subject of the proposed action, several listed and candidate species may occur in the action area. These include the endangered razorback sucker, southwestern willow flycatcher, cactus ferruginous pygmy-owl, Huachuca water umbrel, and the threatened bald eagle. Federal agencies are required to ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of the listed species, or destroy or adversely modify designated critical habitat in accordance with section 7(a)(2) of the Act. Activities that adversely modify critical habitat are defined as those actions that appreciably diminish the value of critical habitat for both the survival and recovery of the species (50 CFR 401.02). Activities that jeopardize a species are defined as those actions that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of the listed species (50 CFR 402.02). According to these definitions, activities that destroy or adversely modify critical habitat would ordinarily jeopardize the species. Therefore, designation of critical habitat has very rarely resulted in greater protection than that afforded under section 7 by the listing of a species. Section 7 consultations apply only to actions with Federal involvement (i.e., activities authorized, funded, or conducted by Federal agencies), and do not impact activities strictly under State or private authority.

In practice, the designation of critical habitat for spikedace and loach minnow will effectively provide no additional benefits to the species in presently occupied areas because there are functioning program activities already alerting Federal agencies and the public of endangered species concerns. However, there may be some benefits in unoccupied habitat. Until we have completed surveying Federal agencies for their assessment of the impact of critical habitat designation, we are unable to reliably estimate those impacts.

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