United States Department of the Interior

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2-21-01-F-272 August 15, 2001

Mr. Michael Sommerville
State Conservationist
U.S. Department of Agriculture
Natural Resources Conservation Service
3003 North Central Avenue, Suite 800
Phoenix, Arizona 85012-2495

Dear Mr. Sommerville:

This document transmits the Fish and Wildlife Service's (Service) biological opinion based on the July 10, 2001, receipt of the National Resources Conservation Service (NRCS) June 27, 2001, letter requesting initiation of formal section 7 consultation under the Endangered Species Act of 1973, (16 U.S.C. 1531 et seq.) as amended. The consultation concerns possible effects of your proposed Bayless Emergency Watershed Bank Stabilization Protection Project on the Verde River in Yavapai, County, Arizona, on endangered razorback sucker (*Xyrauchen texanus*), and threatened spikedace (*Meda fulgida*), and loach minnow (*Tiaroga cobitis*) plus designated critical habitat of spikedace, loach minnow, and razorback sucker. In our 30-day acknowledgment letter we provided concurrences for your determination of "may affect, not likely to adversely affect" for southwestern willow flycatcher (*Empidonax traillii extimus*) and Gila topminnow *(Poeciliopsis occidentalis occidentalis)*. Additionally you made a "no effect" determination for bald eagle (*Haliaeetus leucocephalus*) and Arizona cliffrose (*Purshia subintegra*).

The Verde River has been stocked with non-essential experimental populations of Colorado pikeminnow (*Ptychocheilus lucius*), formerly called Colorado squawfish. For the purpose of section 7 consultation, species designated as experimental non-essential under 10 (J) of the Act are treated as proposed species for listing. You have provided a determination of non-jeopardy for this fish, pursuant to conferencing procedures 50 CFR 402.10.

The following biological opinion is based on the information provided in the April 11, 2001, biological assessment (BA), data in our files, our April 5, 2001 field trip, and other sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern or other subjects considered in this opinion. A complete administrative record of this consultation is on file in this office.

Consultation History

The NRCS has entered into a cost share agreement with the private landowners to provide funding and technical assistance for the project for bank protection. Informal consultation began on March 27, 2001 when the NRCS contacted this office. On April 5, 2001, Greg Beatty, U.S. Fish and Wildlife Service, went on a field trip to the site with the NRCS staff and met with the landowners. We received the Biological Assessment from the NRCS on April 11, 2001. The Service responded on May 3, 2001, with a non-concurrence letter regarding effects determination for spikedace, loach minnow, razorback sucker, and their designated critical habitats. The NRCS requested the initiation of formal consultation through correspondence this office received on July 10, 2001. Formal consultation for loach minnow, spikedace, and razorback sucker was initiated on July 31, 2001.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The NRCS, using Emergency Watershed Protection funds, plans to protect private property (crop-land and buildings) from bank erosion along the Verde River (between the towns of Cottonwood and Clarkdale) near the Verde Village in Yavapai County, Arizona. The Verde River flows at the base of an approximate 15 foot-tall sheer, bare dirt bank that since 1996, has eroded by as much as 100 feet. This bank is just upstream of a sharp bend in the river. To prevent continued erosion of this bank and future loss of private property at the top of this bank, about 23 Kellner Jacks extending 350 feet will be placed at the base, along the length of the sheer bank. Kellner Jacks are metal structures surrounded by cable and anchored to the ground that are intended the stabilize banks and stop erosion. Work is expected to take from 3 to 10 days to complete during August or September, 2001.

The action area for this project is defined as all areas to be affected directly or indirectly by the Federal action. In streams, the action area is often much larger than the area of the proposed project because impacts may be carried downstream with the flow, and radiating channel adjustments, both upstream and downstream, occur whenever stream channels are altered (Dunne and Leopold 1978). However, those distances are hard to predict and are highly dependent upon localized channel geomorphology, and flooding during and after the project. For the proposed project, the upstream extent of the affected, or action, area is a half mile upstream of the most northern Kellner Jack and 1 mile downstream of the most southern Kellner Jack.

Conservation Measures:
The NRCS has included a number of conservation measures in the proposed project. These include: (1) lowering the Kellner Jacks to the river from on top of the high bank with a crane; (2) restricting any use of heavy equipment in the stream; (3) planting cottonwood and willow trees behind the Kellner Jacks; (4) only allowing foot entrance to the stream to anchor and attach the Kellner Jacks and; (5) delaying work until after June to reduce impacts to spawning native fish.

STATUS OF THE SPECIES

Loach minnow

Loach minnow was listed as a threatened species on October 28, 1986 (USFWS 1986a). Critical habitat was designated for loach minnow on April 25, 2000 (USFWS 2000a). Critical habitat includes portions of the Verde, Black, middle Gila, San Pedro, San Francisco, Tularosa, Blue, and upper Gila rivers and Eagle, Bonita, Tonto, and Aravaipa creeks and several tributaries of those streams. Most the upper Verde River including the Verde Valley (including the towns of Clarkdale, Cottonwood, and Camp Verde) is designated critical habitat. This includes the entire project and action area.

Constituent elements for both spikedace and loach minnow include habitat components that contribute to a healthy river system such as permanent, flowing, unpolluted water; areas of slow to relatively swift flow velocities in shallow water; moderate to high instream cover; pool, riffle, run, and backwater components; low to moderate stream gradient; periodic flooding; abundant aquatic insect prey base; habitat devoid of nonnative fish; uncemented sand, gravel, and cobble substrates; low to moderate amounts of fine sediment and substrate embeddedness; a hydrograph that demonstrates an ability to support a native fish community; and water temperatures in the approximate range of 1-30˚C (35-85˚ F; USFWS 2000a).

The loach minnow is a small, slender, elongate fish with markedly upwardly-directed eyes (Minckley 1973). The historic range of loach minnow included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila rivers (Minckley 1973, Sublette et al. 1990). Habitat destruction plus competition and predation by nonnative species have reduced the range of the species by about 85 percent (Miller 1961, Williams et al. 1985, Marsh et al. 1989). Loach minnow remains in limited portions of the upper Gila, San Francisco, Blue, Black, Tularosa, and White Rivers; and Aravaipa, Turkey, Deer, Eagle, Campbell Blue, Pace, Frieborn, Negrito, Whitewater, and Dry Blue creeks in Arizona and New Mexico (Barber and Minckley 1966, Silvey and Thompson 1978, Propst et al. 1985, Propst et al. 1988, Marsh et al. 1990, USFWS 1994b, Bagley et al. 1995, Bagley et al. 1998, Miller 1998).

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 lee of, larger substrate for resting and spawning (Propst et al. 1988, Rinne 1989). It is rare or absent from habitats 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 two 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 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).

Biochemical genetic work on loach minnow indicate there are substantial differences in genetic makeup between remnant loach minnow populations (Tibbets 1993). Remnant populations occupy isolated fragments of the Gila River basin and are isolated from each other. Based upon 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.

The status of loach minnow is declining range-wide. Although it is currently listed as threatened, the Service has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal is pending, however work on it is precluded due to work on other higher priority listing actions (USFWS 1994b).

Spikedace

Spikedace was listed as a threatened species on July 1, 1986 (USFWS 1986b). Critical habitat was designated for spikedace on April 25, 2000 (USFWS 2000a). Critical habitat includes portions of the Verde, middle Gila, San Pedro, San Francisco, Blue, and upper Gila rivers and Eagle, Bonita, Tonto, and Aravaipa creeks and several tributaries of those streams. Most the upper Verde River including the Verde Valley (including the towns of Clarkdale, Cottonwood, and Camp Verde) is designated critical habitat.

Spikedace is a small silvery fish whose common name alludes to the well-developed spine in the dorsal fin (Minckley 1973). Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from the Verde, middle Gila, and upper Gila rivers, and Aravaipa and Eagle creeks (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Marsh et al. 1990, Sublette et al. 1990, Jakle 1992, Knowles 1994, Rinne 1999). Habitat destruction and degradation along with competition and predation from introduced nonnative species are the primary causes of the species decline (Miller 1961, Williams et al. 1985, Douglas et al. 1994).

Spikedace live in flowing water with slow to moderate 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 the 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 in the wild, but spawning behavior and captive studies indicate eggs are laid over gravel and cobble where they adhere to the substrate. 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 from 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 geographic variation within the species (Tibbets 1992, 1993).

The status of spikedace is declining range-wide. Although it is currently listed as threatened, the Service has found that a petition to uplist the species to endangered status is warranted. A reclassification proposal is pending, however, work on it is precluded due to work on other, higher priority, listing actions (USFWS 1994b).

Razorback sucker

The razorback sucker was once abundant in the Colorado River and its major tributaries throughout the basin, occupying 3,500 miles of river in the United States and Mexico (USFWS 1991). Records from the late 1800s and early 1900s indicated the species was abundant in the lower Colorado and Gila river drainages (Kirsh 1889, Gilbert and Scofield 1898, Minckley 1983, Bestgen 1990). Critical habitat was designated in 1994 (USFWS 1994a).

Razorback sucker grows to over two feet in length and has a distinctive, abrupt, sharp edged dorsal ridge behind the head (Minckley 1973). Adult razorback sucker inhabit a wide variety of riverine habitats including main stem and backwater areas such as slow runs, deep eddies, pools, and sloughs (Bestgen 1990). It also inhabits reservoirs. Larval and juvenile razorback sucker habitat includes shallow, slow moving areas, backwaters, and littoral zones (Langhorst and Marsh 1986, Bestgen 1990). Razorback suckers spawn from January to May and initiation of spawning appears to be tied to water temperature (Langhorst and Marsh 1986, Tyus and Karp 1990). Spawning occurs in shallow water over large gravel, cobble, or coarse sand with little or no fine sediment, on wave-washed lakeshores, or on riverine riffles (Minckley et al. 1991). Razorback sucker live up to about 50 years (McCarthey 1987). It feeds on plankton, algae, and detritus in reservoirs, with riverine populations also consuming a large amount of benthic invertebrates (Bestgen 1990).

The razorback sucker was listed as an endangered species, due to declining or extirpated populations throughout the range of the species (USFWS 1991). The causes of these declines are changes to biological and physical features of the habitat. The effects of these changes have been most clearly noted by the almost complete lack of natural recruitment to any population in the historic range of the species. Populations are generally small and composed of aging individuals. Recovery efforts under the Recovery Implementation Program in the upper Basin have begun, but significant recovery results have not been achieved for this species. In the Lower Basin, efforts to reintroduce the species in the Gila, Salt, and Verde rivers have not been successful in establishing self-sustaining populations. Reintroduction efforts are currently ongoing only on the Verde River. Augmentation efforts along the lower Colorado River propose to replace the aging populations in Lake Havasu and Mohave with young fish from isolated grow-our facilities. This may prevent the imminent extinction of the species in the wild, but does not appear capable of ensuring long-term survival or recovery. Overall, the status of the razorback sucker continues to decline.

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.

The Verde Valley between the towns of Cottonwood and Camp Verde is characterized by a wide flood basin once dominated by Fremont cottonwoods. Although cottonwood stands and riparian vegetation persist, dense understory is largely absent and the contiguous habitat is now fragmented (Paxton et al 1997). The quality and quantity of suitable aquatic habitat for threatened and endangered fish in the Verde Valley has been affected through numerous past actions resulting in reduction of riparian habitat, altered species composition, increased presence of exotic fish, decreased surface water availability, changes in stream morphology, and other factors. A significant portion of the adverse impacts to the Verde River and its aquatic and riparian ecosystem come from the additive effect of small actions that individually may not threaten the system, but cumulatively result in continuing deterioration of the ecosystem.

Habitat for threatened and endangered fish in the Verde River has undergone major changes in the past 150 years, with the Verde Valley being the most highly modified (excluding Horseshoe and Bartlett lakes). The volume and pattern of flow in the river, particularly within the Verde Valley has been modified by water diversion, groundwater pumping, and watershed alteration. The river channel has been modified by removal or use of riparian vegetation, flood control, construction of diversion dams, roads and bridges, gravel mining, and agricultural/suburban development of the floodplain. Additionally, various non-native fish have been and continue to be introduced into the Verde River system that have adversely affected threatened and endangered and other native fish through predation and competition (Marsh and Brooks 1989, Minckley et al. 1991, Hendrickson 1993, Rinne 1999)

Flooding is often considered the "natural" reason for the degraded condition of the Verde River and other streams in the Southwest. Although flooding may appear to be a disruptive force on stream channels, maintenance of the stream's dynamic equilibrium requires the full range of flows occurring in nature and "it is an important characteristic of a natural channel to accept both high and low flows with their associated sediment load without long-term changes in morphology" (Leopold 1997). Floods may rearrange materials within the channel and floodplain, but the channel returns to a state that is determined by geology, gradient, and sediment load, among other factors. The stream’s dynamic equilibrium does not mean the stream channel always returns to exactly the same location. "The manner in which a channel moves across the valley floor, eroding one bank and building a nearly flat floodplain on the other, while maintaining a cross section approximately constant in shape and size, is an aspect of the dynamic equilibrium that characterizes many channel systems" (Leopold 1997).

Human disturbances of the watershed, floodplain, and stream channel change many of the factors determining channel configuration. Increased sediment off the watershed is a common

result of human actions and sediment is a major determinant of channel shape (Leopold 1997). When the dynamic equilibrium has been disrupted, the channel begins a process of adjustment as it attempts to restore a dimension, pattern, and profile that are consistent with controlling hydraulic variables (Rosgen 1996). These adjustments may lead to dramatic changes in the stream channel width, depth, and geometry that encroach on human activities, such as has occurred on the Verde River. As human activities are affected, additional flood control and channelization measures may occur, which exacerbate the problems in adjacent areas (Pearthree and Baker 1987), and the channel will continue to become increasingly unstable.

Flood control, channelization and bank stabilization efforts usually take one of several forms: diking, riprap, soil-cement, Kellner Jacks and/or gabions parallel to the channel; check dams across the channel; removal of woody debris from the channel and floodplain; and rerouting the channel. More rudimentary forms of bank stabilization can be found when old vehicles or other large objects are found stacked along a river bank. It is unknown how many efforts such as described above have occurred along the Verde River prior to the listing of threatened and endangered species and designation of critical habitat on the Verde River. A quarter mile of Kellner Jacks were placed at Dead Horse State Park on the Verde River upstream of this project area after 1993 flooding, but did not stay in place following the 1995 floods and traveled downstream (M. Chew, AZ State Parks, pers. com.).

Removing trees, logs, and other woody debris from stream channels is a common form of flood control practiced by landowners and is seldom documented. Woody debris is very important in stream function and fish habitat (Minckley and Rinne 1985, Debano et al. 1996). In the Verde Valley, removing riparian vegetation for this purpose continues (F. Toupal, NRCS, pers. com.).

Loach minnow was last detected in the main stem of the Verde River in 1938 (Minckley 1993). Surveys for loach minnow in tributaries of the Verde River are underway, but none have been detected (USFWS unpubl. data). Suitable habitat and the lack of surveys leads us to conclude the species may still occur in the watershed.

Spikedace continue to be recorded from the upper Verde River, although since 1996 they have been very rare, with none found in 1997 and 1998 and only two found in 1999. This dramatic fluctuation is similar to earlier fluctuations, but better documented (USFWS 2000a).

Razorback sucker was historically found in the Verde River at least as far upstream as Perkinsville (Minckley and Alger 1968). Due to habitat alterations and spread of non-native species, razorback sucker was extirpated from the Verde River, with the last record at Peck's Lake in 1954 (Wagner 1954, Minckley 1973). Beginning in 1981 and continuing through the 1990s, razorback sucker have been reintroduced into the upper Verde River. Predation from non-native species was believed to a major cause of mortality from the initial stockings. This was later managed for by placing larger fish, less susceptible to predation, in the river. Monitoring studies have shown that reintroduced razorback sucker in the Verde River use pools, runs, and backwaters, with some use of eddies (Creef et. al 1992, Hendrickson 1993). The Verde River in the project area and throughout the Verde Valley is designated critical habitat for the razorback sucker (USFWS 1994a).

The Verde River is vital to the survival and recovery of spikedace, loach minnow, and razorback sucker. Spikedace historically occurred throughout the mid-elevations of the Gila River drainage, but is currently known only from the Verde, middle Gila, and upper Gila rivers, and Aravaipa and Eagle creeks (Barber and Minckley 1966, Minckley 1973, Anderson 1978, Marsh et al. 1990, Sublette et al. 1990, Jakle 1992, Knowles 1994, Rinne 1999). Thus, the remaining spikedace are vital for recovery. While loach minnow has not been found recently in the Verde River, surveys continue to try to find populations of this small fish (USFWS unpubl. data). Therefore, designated critical habitat for loach minnow is important to protect what habitat may exist for fish in the Verde River so that it can support future repatriation of loach minnow. Other than the lower Colorado River, the upper Verde River is the only location in central Arizona where razorback sucker has been consistently reintroduced and where the fish may be successfully established.

Formal consultation has documented various effects from Federal actions to razorback sucker, spikedace, and loach minnow which contributed to the environmental baseline (Appendix 1). Some of these actions contained components that lessened adverse effects of ongoing actions or were aimed at improving watershed conditions (livestock grazing management changes, etc.). While take was authorized in many instances, actions to reduce and minimize take through reasonable and prudent measures were implemented.

EFFECTS OF THE ACTION

The proposed action is expected to have adverse effects to spikedace, loach minnow, razorback sucker and their critical habitats. Some of these effects will be short-term, but most are expected to be long-term. Given the tentative nature of the populations of these fish in the Verde River, the degraded environmental baseline, and cumulative effects (from private and/or non-Federal entities), additional adverse effects or loss of recovery potential must be assessed.

The purpose of the proposed action is to repair damage from flooding, control erosion, protect the stream bank, and prevent further loss of private property. The portion of the Verde River where bank stabilization is needed is immediately upstream of a sharp bend along a fairly straight stretch of stream. The river has cut into the streambank creating a short bend. The natural tendency of a stream is toward sinuosity and to cut outward on the outside curve of channel bends (Leopold 1997, Rosgen 1996). After examining USGS 7.5 minute topographic maps and aerial photographs, the river may have traveled more regularly through the wide western portion of the floodplain. Possible alteration of the stream channel during flood events from 1993 and 1995 or man-made alterations has caused the river to cut into the eastern stream bank. Thus, the house and power line on top of the river bank are threatened by the natural or human-caused outward erosion. Erosion repair and prevention using Kellner Jacks will redirect the stream's energy elsewhere (most likely downstream). This may only temporarily solve the lateral erosion problem at the project site (Dunne and Leopold 1978, Pearthree and Baker 1987), but if the lateral erosion continues despite the repair efforts, the effect of the project is the difference between erosion that occurred with the repair structures minus that which may have occurred without the structures.

Short-term effects typically expected from the proposed project are those associated with the actual construction activities and increased sedimentation. Adverse effects of stream sedimentation to fish and fish habitat have been extensively documented (Murphy et al. 1981, Wood et al. 1990, Newcombe and MacDonald 1991, Barrett 1992, Waters 1995). Excess sediment fills the interstitial spaces where they live and may smother eggs (Propst et al. 1988). However, we do not expect that sedimentation for this project to be a significant issue as result of the limited amount of work occurring in the stream itself and the lowering of Jacks into the water from on top of the east bank by a crane. Additionally, the total amount of sediment is unlikely to be at a level it would cause channel alteration. Although improbable events (e.g., flooding during construction) may increase erosion or the downstream extent of effects, large amounts of sediment are not expected to be generated by this project.

Some short-term effects may occur as a result of placement of Jacks in the river and human activity required in anchoring and joining the structures. There may also be effects from introduction of toxic substances into the river such as petroleum products from project equipment. Direct mortality to fish, eggs, or fry from these activities could occur.

Most of the area in which Kellner Jacks will be placed is currently a pool or run habitat. While spikedace and razorback sucker will use this habitat, loach minnow will not likely be found there. However, the filling of the pooled edge will cause the channel to adjust and will alter the location and configuration of adjacent riffle habitats. It may also decrease the amount of shear habitat used by spikedace by altering the interface of slow and fast water areas. Whether these changes will result in the same, less, or more habitat for spikedace, razorback sucker, or loach minnow cannot be predicted.

Long-term effects expected from the project include effects on the channel morphology from channel constraint. As discussed earlier in the environmental baseline section, bank stabilization projects, such as the one proposed here, have ramifications for the channel up and downstream from the project site. The need for this project may have actually been the result of bank stabilization and other flood control actions occurring upstream. Additionally, installation of this project may lead to the need for bank stabilization downstream. Ultimately, effects continue to move downstream as the river continues to lose natural function. A similar cause and effect relationship may have occurred on Eagle Creek where the NRCS and Forest Service needed to install rip rap along the creek's bank (USFWS 2000b).

Also, as discussed in the environmental baseline section, the Verde River through the Verde Valley has been altered by various actions, including flood control and bank and channel stabilization, roads, bridges, urbanization, etc. The lack of comprehensive data on the extent to which the Verde River has been affected by these activities precludes us from understanding with any certainty how this particular addition contributes to the overall loss of the natural channel form and function. Dissecting the effects of the present project from those from the past alteration is very difficult and cannot be done without gathering much more extensive data. The long-term recovery and survival of razorback sucker, spikedace and loach minnow in the upper Verde River depend heavily on recovery of the stream channel to a more natural system in dynamic equilibrium.

The effects to spikedace and razorback sucker from the exacerbation of channel stabilization and loss of ecosystem function is of more direct concern than for loach minnow. Loach minnow has not been documented in the Verde River for many years. However, the designation of the area as critical habitat for loach minnow makes stream function important for eventual re-introduction and recovery of the species. Thus, a primary concern with loach minnow is to ensure that the protection and recovery of critical habitat and that any individuals that might exist in the action area do not continue to decline.

Spikedace and razorback sucker, on other hand, are present in the upper Verde River. While they are not common, they still occur at very low levels throughout the stream. Historic information indicates that the distribution and abundance of both razorback sucker and spikedace in the upper Verde River was much more extensive. Nevertheless, razorback populations have been introduced both upstream of the project area at Perkinsville and downstream of the project site at Childs. Spikedace, while becoming more difficult to detect due to low numbers, small stature, and incomplete surveys, have been located as recently as 1999 on the upper Verde River.

In summary, there are both short and long-term adverse effects from the proposed project that have negative consequences for the spikedace, loach minnow, and razorback sucker and their critical habitats in the Verde River. The banks of the Verde River in Verde Valley have already been altered by a myriad of river oriented projects and the individual effects of these earlier projects are difficult to separate from those of the proposed project.

The American Fisheries Society has adopted a position statement regarding the cumulative effects of small modifications to fish habitat (Burns 1991). That statement concludes that accrual of localized impacts, often from unrelated human actions, can pose a threat to fisheries. It also points out that some improvement efforts to fish habitat may not result in cumulative increases in status of the species, but instead may simply mitigate cumulative habitat alterations from other activities. This is particularly true on the Verde River in the Verde Valley, where the accumulating effects of a large number of small and localized impacts over the past century have resulted in a damaged stream channel with depleted flows and degraded aquatic habitat. As a result, each small and localized project that will affect the stream, and the associated listed fish must be viewed in the context of the current degraded situation.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Most of the land along the Verde River in the Verde Valley through the towns of Clarkdale, Cottonwood, and Camp Verde is privately owned. Ongoing activities occurring on these private lands that would be cumulative to the proposed action include residential use and development, commercial development, gravel mining, road development, surface water diversion, stocking of

non-native aquatic species, groundwater extraction, livestock grazing, and irrigated cropping. These activities are largely the cause for these species to be listed and continue to contribute to the degraded condition of the stream channel and fish habitat in Verde River.

Land use practices in the Verde River watershed, including those of the State, Tribal, private, and other lands may impact spikedace, razorback sucker, loach minnow and designated critical habitat on the Verde River. Stream channelization, bank stabilization, or other instream management for water diversion may impact these fish and their habitat. Most of the activities that would be cumulative to the proposed action are ongoing and are discussed in the environmental baseline section of this opinion.

Conclusion

After reviewing the current status of the spikedace, loach minnow, razorback sucker, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Verde River Bayless Bank Stabilization Project, as proposed, is not likely to jeopardize the continued existence of spikedace, loach minnow, or razorback sucker. It is also the Service's biological opinion that the proposed action is not likely to destroy or adversely modify critical habitat of loach minnow, spikedace, or razorback sucker. These conclusions are based on: 1) numbers of native fishes in the project area are very low and; 2) NRCS has implemented Conservation Measures to minimize adverse effects to native fishes. These conclusions are based on full implementation of the project as described in the "Description of the Proposed Action" section of this document, including the Conservation Measures incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the NRCS. The NRCS has a continuing duty to regulate the activity covered by this incidental take statement. If the NRCS fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the NRCS must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

AMOUNT OR EXTENT OF TAKE

The Service anticipates that the proposed Verde River Bayless Bank Stabilization Project will result in incidental take of spikedace and razorback sucker. Because no loach minnow has been detected in the Verde River in recent historical times (USFWS 2000a), we conclude that no take of loach minnow is expected to occur.

Incidental take of spikedace or razorback sucker could occur as direct loss of adult and juvenile fish and eggs due to crushing during placement of Jacks, and placement of cables and cords, or equipment and materials, associated with Jack installation. Indirect take may occur through destruction or alteration of habitat resulting from permanent modification of the stream banks and stream channel. Such habitat loss or modification would alter behavioral patterns, food availability, access to cover and availability of habitat, thus reducing survival of individual spikedace and razorback sucker, and potentially reducing or precluding reproduction.

The anticipated level of incidental take of spikedace and razorback sucker cannot be directly quantified at this time due to the lack of comprehensive information on populations in the area and to the changes in instream habitat distribution over time. In addition, the rapid population fluctuations inherent in populations of short-lived and currently rare species such as spikedace, make accurate predictions of changes in population numbers impossible. Because of the spikedace's small size, the velocity of the stream, and the rapid consumption of dead or dying fish by predators, it is unlikely that spikedace, or their eggs, that are killed as a result of the proposed project would be observed. Therefore, the Service defines incidental take in terms of the total fish community and habitat, as an index of expected take of spikedace and razorback sucker. The Service concludes that incidental take of spikedace and razorback sucker from the proposed action will be considered exceeded if at any time during project activities any of the following occur:

1. More than 20 dead fish of any species are found in the area of any project activities or within 500 yards downstream,

2. Project machinery and vehicles enter the water at any time,

3. Any spill of toxic materials occurs in the Verde River or its floodplain during, and as a result of, project activities.

Effect of Take

In the accompanying biological opinion, the Service determined that the level of anticipated take is not likely to result in jeopardy to spikedace and razorback sucker, or the destruction or adverse modification of critical habitat for the spikedace, razorback sucker, or loach minnow.

Reasonable and Prudent Measures:

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking.

1. Conduct all proposed actions in a manner that will minimize directly mortality of spikedace and razorback sucker.

2. Conduct all proposed actions in a manner that will minimize loss and alteration of spikedace and razorback sucker habitat.

3. Monitor the fish community and habitat to document levels of take.

4. Maintain a complete and accurate record of actions that may result in take of spikedace and razorback sucker or loss of their habitat.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the NRCS must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The following terms and conditions will implement reasonable and prudent measure 1:

   1.1 All reasonable efforts shall be made to minimize activities within the wetted channel of the Verde River.

   1.2 No water shall be removed from the Verde River during the project.

   1.3 All reasonable efforts shall be made to ensure that no pollutants enter surface waters during action implementation. No toxic chemicals (including petroleum products) shall be stored or deposited within the floodplain during the project or, if stored on the terrace, they shall be secured in such a manner as to prevent them from leaking or being entrained into flood waters. Storage of any toxic materials on the terrace shall be only for the minimum time necessary to accomplish the project. An appropriate spill response kit for cleaning up accidental releases of petroleum products will be available at the work site whenever vehicles or machinery are present and at least one person present shall have training in use of that kit.

   1.4 All Kellner Jacks or other materials placed in the river or floodplain shall be free from toxic substances.

2. The following term and condition will implement reasonable and prudent measure 2:

   2.1 All reasonable efforts shall be made to minimize damage to, or loss of, riparian and floodplain vegetation.

3. The following term and condition will implement reasonable and prudent measure 3:

3.1 At all times when project activities are ongoing, all reasonable efforts shall be maintained to monitor for the presence of dead or dying fish in, or within 500 yards downstream of, the project area. The Service shall be notified immediately by telephone upon detection of more than 20 dead or dying fish of any species.

3.2 A biologist shall be available to advise and assist in application of these terms and conditions. The biologist must be on-site during project activities and ensure that construction personnel are trained in application of these terms and conditions.

3.3 A set of permanent photo points to document project success or failure and stream channel changes in the immediate project area shall be established. Photo points will be sufficient to document the total project length, but will be no less than 10 (including any changes no less than 3/4 mile downstream from the last Kellner Jack and 300 feet upstream of the first Kellner Jack). Pictures at each photo point will be taken over ten years (2001, 2002, 2003, 2007, 2010). Year one will include photos of year 2001 before and after project implementation. Copies of the photos shall be provided to the Service. Along with these photos will be text describing any changes in channel morphology, riparian habitat, erosion, bank stability, etc. as a result of project implementation, and/or changes as result of any other natural and/or unnatural events.

The NRCS may encounter access restrictions to private land within the action area. If the NRCS can not establish photo points and obtain on-site photos within 3/4 of a mile downstream of the Kellner Jacks, then the NRCS will try to augment the photo points by using current aerial photos and/or pictures taken of the action area from a nearby high point. To compensate for loss of on-site photo points, the NRCS will move permanent photo points downstream the distance unable to be recorded by on-site photo points.

4. The following terms and conditions will implement reasonable and prudent measure 4:

4.1 A written report shall be submitted to the Service within 90 days of completion of the project. The report shall document the project, as implemented, and shall include photographs of the project area before project initiation and after project completion. The report shall also include a discussion of compliance with the above reasonable and prudent measures and terms and conditions.

4.2 Habitat monitoring information (i.e., photographs and text) shall be submitted every year photos points are taken containing the information obtained from the photo points and analysis (a total of 5 reports for 2001, 2002, 2003, 2007, 2010). A summary analysis, including a synthesis of channel condition and comparison with respect to information collected in prior years, will be submitted along with the annual report at year 6 (2007). Year 10 (2010) will include the last three years of information and summarize the decade of monitoring into a final report.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. In order for the Service to kept informed of actions minimizing or avoiding adverse effects or benefitting listing species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

1. The NRCS should work with private landowners, local municipalities, power and telephone companies, and state and federal agencies to move roads, transmission poles, and other movable structures to locations where they are not in the path of natural stream erosion. This would preclude the need for stream channel modification to protect these facilities.

2. The NRCS by themselves or in conjunction with other local, state and/or federal agency (Forest Service, Army Corps of Engineers, Towns of Clarkdale, Cottonwood, Camp Verde, etc.) should conduct a comprehensive study of historic and existing channelization, flood control, and other channel modification activities in the Verde Valley. The results of this study should be used to formulate long-range plans to restore the natural channel and function of the Verde River and achieve recovery of spikedace, loach minnow, razorback sucker, the native fish community, southwestern willow flycatcher, and bald eagle. Additional channel modification projects should not be considered or implemented on Forest or private lands until such planning is completed to ensure that any future projects are compatible with long-term channel restoration and health.

3. The NRCS should work with local communities to develop ordinances that would prevent future development from being at risk from natural river functions and thus the need to modify the river. Educate communities on issues such as maintaining dense riparian habitat and mesquite bosques along side rivers to ensure control of erosion, slowing of flood forces, and filtering of pollutants. In conjunction, work to develop buffer zones between development and the 100 year floodplain that would protect and prevent damage to permanent structures, pavement, roads, agricultural fields, etc.

4. The NRCS should work with the Prescott and Coconino National Forests to improve the health of the watershed on the upper Verde River and its tributaries. Ensuring dense riparian vegetation and healthy vegetated upland ranges reduces the volume and force of downstream flooding which would subsequently limit the damage to private property and need for river stabilization/modification projects.

REINITIATION NOTICE

This concludes consultation for the Verde River Bayless Bank Stabilization Project. As required by 50 CFR 402.16, reinitiation of formal consultation is required if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the action is subsequently modified in a manner that causes an effect on the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. When the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate your efforts in this consultation. If we can be of further assistance, please contact Greg Beatty (x247) or Debra Bills (x239). Please refer to consultation number 2-21-01-F-272 in further communication on this project.

Sincerely,

/s/
David L. Harlow
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Nongame Branch Chief, Arizona Game and Fish Department, Phoenix, AZ
Habitat Branch Chief, Arizona Game and Fish Department, Phoenix, AZ
State Conservationist, NRCS, Phoenix, AZ
Forest Supervisor, Prescott National Forest, Prescott, AZ

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Literature Cited

Abarca, F.J. 1987. Seasonal and diet patterns of feeding in loach minnow. Proceedings of the Desert Fishes Council 19:20.

Anderson, R.M. 1978. The distribution and aspects of the life history of *Meda fulgida* in New Mexico. MS Thesis. New Mexico State Univ., Las Cruces. 62 pp.

Anderson, A. A. and D. A. Hendrickson. 1994. Geographic variation in morphology of spikedace, *Meda fulgida*, in Arizona and New Mexico. The Southwestern Naturalist 39(2):148-155.

Bagley, B., G.W. Knowles, and T.C. Inman. 1995. Fisheries survey of the Apache-Sitgreaves National Forests, trip reports 1-9. May 1994 to September 1995. Arizona State University, Tempe, AZ. 50 pp.

Bagley, B., B. Kesner, and C. Secor. 1998. Upper Blue River and tributaries. Fisheries survey. June-July 1998. Arizona State University, Tempe, AZ. 25 pp.

Barber, W.E. and W.L. Minckley. 1966. Fishes of Aravaipa Creek, Graham and Pinal Counties, Arizona. Southwestern Naturalist 11(3):313-324.

Barber, W.E. and W.L. Minckley. 1983. Feeding ecology of a southwestern Cyprinid fish, the spikedace, *Meda fulgida* Girard. The Southwestern Naturalist 28(1):33-40.

Barber, W. E., D. C. Williams, and W. L. Minckley. 1970. Biology of the Gila spikedace, *Meda fulgida*, in Arizona. Copeia 1970(1): 9-18.

Barrett, J.C. 1992. Turbidity-induced changes in reactive distance of rainbow trout. Transactions of the American Fisheries Society 121:437-443.

Bestgen, K.R. 1990. Status review of the razorback sucker. Xyrauchen texanus. Colorado State Univ. Larval Fish Laboratory, Contribution 44, Fort Collins, Colorado.

Britt, K.D. 1982. The reproductive biology and aspects of life history of *Tiaroga cobitis* in southwestern New Mexico. MS. Thesis, New Mexico State University. 56 pp.

Burns, D.C. 1991. Cumulative effects of small modifications to habitat. Fisheries 16(1):12-17.

Creef, E.D., R.W. Clarkson, and D.K. McGuinn Robbins. 1992. Razorback sucker and Colorado squawfish reintroduction and monitoring, Salt and Verde rivers, Arizona, 1991-1992. Arizona Game and Fish Department, Special Report on Project E5-3, Job 7, Phoenix, Arizona.

DeBano, L.F., P.F. Ffolliott, and K.N. Brooks. 1996. Flow of water and sediments through southwestern riparian systems. pp. 128-134 *In*: Desired future conditions for southwestern riparian ecosystems: bringing interests and concerns together. September 18-22, 1995. Shaw, D.W. and D. M. Finch, Eds. U.S. Forest Service Rocky Mountain Forest and Range Experiment Station General Technical Report RM-GTR-272. Ft. Collins, CO.

Douglas, M. E., P. C. Marsh, and W. L. Minckley. 1994. Indigenous fishes of western North America and the hypothesis of competitive displacement: Meda fulgida (Cyprinidae) as a case study. Copeia 1994(1):9-19.

Dunne, T., and L.B. Leopold. 1978. Water in environmental planning. W.H. Freeman and Co. New York. 818 pp.

Gilbert, C.H. and N.B. Scofield. 1898. Notes on a collection of fishes from the Colorado basin in Arizona. Proceedings U.S. National Museum 20:1131.

Hendrickson, D.A. 1993. Evaluation of the razorback sucker and Colorado squawfish reintroduction programs in central Arizona based surveys of fish populations in the Salt and Verde rivers from 1986 to 1990. Arizona Game and Fish Department, Phoenix, Arizona.

Jakle, M. 1992. Memo Feb. 26, 1992 - Summary of fish and water quality sampling along the San Pedro River from Dudleyville to Hughes Ranch near Cascabel, Oct. 24 and 25, 1992, and the Gila River from Coolidge Dam to Ashurst/Hayden Diversion Dam, Oct. 28-31, 1991. U.S. Bureau of Reclamation, Phoenix, AZ. 11 pp.

Kirsch, P.H. 1889. Notes on collection of fishes obtained in the Gila River at Fort Thomas, Arizona. Proceedings of the U.S. National Museum 11:555-558.

Knowles, G.W. 1994. Fisheries survey of the Apache-Sitgreaves national Forests, third trip report: Eagle Creek, June 05-07 and August 02, 1994. Arizona State University, Tempe, AZ. 6 pp.

Langhorst, D.R. and P.C. Marsh. 1986. Early life history of razorback sucker in Lake Mohave. U.S. Bureau of Reclamation, Boulder City, NV.

Leopold, L.B. 1997. Water, rivers and creeks. University Science Books, Sausalito, CA. 185 pp.

Marsh, P.C. and J.E. Brooks. 1989. Observations on recruitment and ecology of razorback sucker: Lower Colorado River, Arizona-California-Nevada. Great Basin Naturalist 49, 71-78.

Marsh, P.C., F.J. Abarca, M.E. Douglas, and W.L. Minckley. 1989. Spikedace *(Meda fulgid*a) and loach minnow *(Tiaroga cobiti*s) relative to introduced red shiner *(Cyprinella lutrensi*s). Report to Arizona Game and Fish Department. Phoenix, Arizona. 116 pp.

Marsh, P.C., J.E. Brooks, D.A. Hendrickson, and W.L. Minckley. 1990. Fishes of Eagle Creek, Arizona, with records for threatened spikedace and loach minnow *(Cyprinida*e). Journal of the Arizona-Nevada Academy of Science 23(2):107- 116.

McCarthey, M.S. 1987. Age estimates for razorback sucker (Pisces: Catostomidae) from Lake Mohave, Arizona, and Nevada. Journal of the Arizona-Nevada Academy of Science 21:87-97.

Miller, R.R. 1961. Man and the changing fish fauna of the American southwest. Papers of the Michigan Academy of Science,Arts,and Letters 46:365-404.

Miller, D. 1998. Fishery survey report. Negrito Creek within the Gila National Forest, New Mexico. 29 and 30 June 1998. Gila National Forest, Silver City, NM. July 14, 1998. 7 pp.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, AZ. 293 pp.

Minckley, W.L. 1983. Status of the razorback sucker, *Xyrauchen texanus* (Abbott), in the lower Colorado River Basin. The Southwestern Naturalist 28:165-187.

Minckley, W.L. 1993. A review of fishes in the Coconino National Forest Region, Arizona. U.S. Forest Service, Flagstaff, AZ.

Minckley, W.L. and N.T. Alger. 1968. Fish remains from an archaeological site along the Verde River, Yavapai, County, Arizona. Plateau 40:91-97.

Minckley, W.L. and J.N. Rinne. 1985. Large woody debris in hot-desert streams: an historical review. Desert Plants 7:142-153.

Minckley, W.L., P.C. Marsh, J.E. Brooks, J.E. Johnson, and B.L. Jensen. 1991. Management toward recovery of the razorback sucker. pp. 303-357 *In*: Battle Against Extinction: Native fish management in the American West. Minckley, W.L. and J.E. Deacon, Eds. University of Arizona Press, Tucson.

Murphy, M.L., C.P. Hawkins, and N.H. Anderson. 1981. Effects of canopy modification and accumulated sediment on stream communities. Transactions of the American Fisheries Society 110:469-478.

Newcombe, C.P. and D.D. McDonald. 1991. Effects of suspended sediments on aquatic ecosystems. North American Journal of Fisheries Management 11:72-82.

Paxton, E., S.M. Langridge, and M.K. Sogge. 1997. Banding and population genetics of southwestern willow flycatchers in Arizona, 1997 summary report. Colorado Plateau

Research Station. U.S. Geological Survey Biological Resources Division, Northern Arizona University, Flagstaff, AZ.

Pearthree, M.S. and V.R. Baker. 1987. Channel change along the Rillito Creek system of southeastern Arizona 1941 through 1983. Implications for flood-plain management. Arizona Bureau of Geology and Mineral Technology, Geological Survey Branch. Special Paper 6. 58 pp.

Propst, D.L., P.C. Marsh, and W.L. Minckley. 1985. Arizona survey for spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*): Fort Apache and San Carlos Apache Indian Reservations and Eagle Creek, 1985. U.S. Fish and Wildlife Service, Albuquerque, NM. 8 + maps pp.

Propst, D. L., K. R. Bestgen, and C. W. Painter. 1986. Distribution, status, biology, and conservation of the spikedace (*Meda fulgida*) in New Mexico. Endangered Species Report No. 15. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 93 pp.

Propst, D.L., K.R. Bestgen, and C.W. Painter. 1988. Distribution status, biology, and conservation of the loach minnow *(Tiaroga cobitis*) in New Mexico. U.S. Fish and Wildlife Service, Albuquerque, New Mexico, Endangered Species Report number 17. 75 pp.

Propst, D.L. and K.R. Bestgen. 1991. Habitat and biology of the loach minnow, *Tiaroga cobitis*, in New Mexico. Copeia 1991(1):29-38.

Rinne, J. N., and E. Kroeger. 1988. Physical habitat used by spikedace, *Meda fulgida*, in Aravaipa Creek, Arizona. Proceedings of the Western Association of Fish and Wildlife Agencies Agenda 68:1-10.

Rinne, J.N. 1989. Physical habitat uses by loach minnow, *Tiaroga cobitis*, in southwestern desert streams. Southwest Naturalist 34(1):109-117.

Rinne, J.N. 1999. The status of spikedace (*Meda fulgida*) in the Verde river, 1999: implications for management and research. Hydrology and Water Resources of Arizona and the Southwest. Proceedings of the 1999 meetings of the hydrology section, Arizona-Nevada Academy of Science Vol. 29.

Rosgen, D. 1996. Applied river morphology. Wildland Hydrology. Pagosa Springs, CO.

Schreiber, D.C. 1978. Feeding interrelationships of fishes of Aravaipa Creek, Arizona. Arizona State University, Tempe, AZ. 312 pp.

Silvey, W. and M.S. Thompson. 1978. The distribution of fishes in selected streams on the Apache-Sitgreaves National Forest. Completion report to USDA Forest Service. Arizona Game and Fish Department, Phoenix, AZ. 49 pp.

Sublette, J.E., M.D. Hatch, and M. Sublette. 1990. The fishes of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 393 pp.

Tibbets, C.A. 1992. Allozyme variation in populations of the spikedace *Meda fulgida* and the loach minnow *Tiaroga cobitis.* Proceedings of the Desert Fishes Council 24:37.

.

Tibbets, C.A. 1993. Patterns of genetic variation in three cyprinid fishes native to the American southwest. MS Thesis. Arizona State University, Tempe, AZ. 127 pp.

Tyus, H.M. and C.A. Karp. 1990. Spawning and movements of razorback sucker, Xyrauchen texanus, in the Green River basin of Colorado and Utah. The Southwestern Naturalist 34 (4):427-433.

U.S. Fish and Wildlife Service. 1986a. Endangered and threatened wildlife and plants; final rule to determine *Tiaroga cobitis* to be a threatened species without critical habitat. *Federal Register* 51 (208):39468-39478.

U.S. Fish and Wildlife Service. 1986b. Endangered and threatened wildlife and plants; determination of threatened status for the spikedace. *Federal Register* 51(126):23769-23781. July 1, 1986.

U.S. Fish and Wildlife Service. 1991. Endangered and threatened wildlife and plants; determination of endangered status for the razorback sucker (*Xyrauchen texanus*). *Federal Register* 56: 54957.

U.S. Fish and Wildlife Service. 1994a. Final determination of critical habitat for four Colorado River endangered fishes. *Federal Register* 59 (54):13374-13400.

U.S. Fish and Wildlife Service. 1994b. Notice of 90-day and 12-month findings on a petition to reclassify spikedace (*Meda fulgida*) and loach minnow (*Tiaroga cobitis*) from threatened to endangered. *Federal Register* 59 (131):35303-35304.

U.S. Fish and Wildlife Service. 2000a. Endangered and threatened wildlife and plants; final designation of critical habitat for the spikedace and loach minnow. *Federal Register* 65(80):24328-24372.

U.S. Fish and Wildlife Service. 2000b. Biological opinion for Eagle Creek bank stabilization. Arizona Ecological Services Office, 10/31/2000. Phoenix, AZ.

Vives, S.P. and W.L. Minckley. 1990. Autumn spawning and other reproductive notes on loach minnow, a threatened cyprinid fish of the American Southwest. Southwest Naturalist 35(4):451-454.

Wagner, R.A. 1954. Basic Survey of the Verde River and its on-stream impoundments. Arizona Game and Fish Department, Phoenix, AZ.

Waters, T.F. 1995. Sediment in streams. Sources, biological effects, and control. American Fisheries Society, Monograph 7, Bethesda, MD. 251 pp.

Williams, J.E., D.B. Bowman, J.E. Brooks, A.A. Echelle, R.J. Edwards, D.A. Hendrickson, and J.J. Landye. 1985. Endangered aquatic ecosystems in North American deserts with a list of vanishing fishes of the region. Journal of the Arizona-Nevada Academy of Science 20(1):1-62.

Wood, D.J., S.G. Fisher, and N.B. Grimm. 1990. Pools in desert streams: limnology and response to disturbance. Journal of the Arizona-Nevada Academy of Science 26:171-182.

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-83-F-013 reconsulted as 2-21-97-F-416	CR	Tonto National Forest Plan	planning	Salt Tonto Verde Gila	spikedace loach minnow Gila topminnow bald eagle peregrine falcon Yuma clapper rail AZ hedgehog cactus AZ agave	07-26-85 superceded by new consultation 12-19-97	ongoing	USFS	RO
2-21-83-F-020 reconsulted as 2-21-97-F-419	CR	Prescott National Forest Plan	planning	Verde Agua Fria	spikedace Gila trout bald eagle peregrine falcon	03-04-86 superceded by new consultation 12-19-97	ongoing	USFS	RO
2-21-83-F-14 reconsulted as 2-21-97-F-416	CR	Coconino National Forest Plan	planning	Verde	spikedace Little Colorado spinedace bald eagle peregrine falcon AZ cliffrose San Fran. peaks groundsel	04-01-86 superceded by new consultation 12-19-97	ongoing	USFS	RO
2-21-93-F-477	NJ	Emergency watershed protection, George Yard property	flooding	Verde	spikedace razorback sucker Colorado squawfish bald eagle	12-27-93	completed	SCS	State Office

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-92-F-550	J AM	Arizona water quality standards	pollution	Gila Salt Black White San Francisco Blue Eagle Bonita Tonto Verde Agua Fria San Pedro Aravaipa Santa Cruz Colorado Virgin Little Col. Bill Williams Yaqui	spikedace (J) loach minnow (J) Apache trout (J) beautiful shiner (NJ/AM) bonytail (J) desert pupfish (J/AM) Gila topminnow (J) Gila trout (J) humpback chub (J) Little Colorado spinedace (J/AM) razorback sucker (J) Sonora chub (J/AM) Virgin chub (J) woundfin (J) Yaqui catfish (NJ/AM) Yaqui chub (J/AM) Yaqui topminnow (J) brown pelican (NJ) bald eagle (J) Yuma clapper rail (J)	2-16-94	ongoing	EPA	San Francisco
2-21-96-F-187 this may have been reinitiated additonal times	NJ	1996 modifications			all those above plus whooping crane Canelo Hills ladies tresses Huachuca water umbel Sonora tiger salamander SW willow flycatcher	12-11-98			

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-90-F-119	J AM	Central Arizona Project potential to introduce and spread nonnative aquatic species	water development	Gila Salt Black White San Francisco Blue Eagle	spikedace (J/AM) loach minnow (J/AM) razorback sucker (J/AM) Gila topminnow (J) desert pupfish (NJ) Colorado squawfish (NJ) bald eagle (NJ)	04-20-94 amended 06-22-95 05-06-98 07-15-98 01-13-00 06-30-00	ongoing	BR	PAO
	NJ	Reinitiation		Bonita Tonto Verde Agua Fria San Pedro Aravaipa	Apache trout (NJ) Gila trout (NJ)	04-17-01			
2-21-93-F-395	NJ NAM	Verde Valley Ranch Dev	Housing	Verde	Razorback sucker (NJ/NAM)	11-09-94	completed	ACOE	DC
2-21-94-F-020	NJ NAM				Razorback sucker (NJ/NAM) SW willow flycatcher (J/AM)	02-23-96		ACOE	DC
2-21-94-F-309	NJ NAM				Razorback sucker, ch (NJ/NAM) SW willow flycatcher, ch (NJ/NAM)	10-07-97		EPA	DC
unnumbered	NE	Rainbow trout stocking in Verde River	stocking	Verde	spikedace razorback sucker Gila topminnow bald eagle	02-06-95	ongoing	FWS	Federal Aid
unnumbered	NJ NAM	Sycamore Canyon Road Stabilization	road	Verde	razorback sucker, ch	02-29-95	completed	FEMA	DC
2-21-95-F-291	NJ/NAM	Cedar Bench Allotment	grazing	Verde	razorback sucker, ch	09-08-95	ongoing	USFS	Tonto NF, Cave Creek RD

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-22-89-F-071	J/AM	West Bear/Del Rio livestock grazing management	grazing	Verde	spikedace (J/AM) razorback sucker (NJ)	draft 09-19-95 withdrawn 07-17-96	ongoing	USFS	Prescott NF Chino Valley RD
no number	INLAA	Ongoing grazing				unknown[2]			
part of 000089RO	INLAA	Ongoing grazing			spikedace (INLAA) razorbacksucker (NLAA) peregrine falcon(INLAA) Colorado squawfish(NLJ) MX spotted owl (INLAA)	04-30-98[2] 09-29-98[2]			
part of 2-22-99-F-016	INLAA	Term permit				verbal in 2000-grazing team			
In consultation	??	ongoing grazing and term permit			spikedace ch loach minnow ch	??-??-			
2-21-94-F-505	NJ/NAM	Tuzigoot bridge repair	construction	Verde	razorback sucker, ch (NJ/NAM) sw willow flycatcher, ch (NJ/NAM)	09-25-95	completed	NPS	State
unnumbered	NE	Stocking of sportfish into 90 locations in Arizona	stocking	Gila Salt Black San Francisco Eagle Tonto Verde Agua Fria San Pedro Santa Cruz Colorado Yaqui	spikedace loach minnow rrazorback sucker humpback chub bonytail chub desert pupfish Gila topminnow Little Colorado spinedace Apache trout beautiful shiner Yaqui chub Yaqui catfish Yaqui topminnow	10-31-95	ongoing	FWS	Federal Aid

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-95-F-413	NJ/NAM	Eureka Ditch	repair	Verde	razorback sucker & ch	12-04-95	completed	NRCS	State
2-21-95-I-440	INLAA	China Dam livestock grazing permit	grazing	Verde	spikedace razorback sucker bald eagle	12-??-95[2]	ongoing	USFS	Prescott NF Chino Valley RD
part of 000089RO	INLAA	ongoing grazing			spikedace loach minnow razorback sucker Colorado squawfish bald eagle peregrine falcon MX spotted owl	04-30-98[2]			
part of 2-22-99-F-016	INLAA	term permit			same as above plus Gila topminnow woundfin	04-20-00[2]			
In consultation	??	ongoing and permit			spikedace ch loach minnow ch	??			
2-21-91-I-075	INLAA	Fish stocking in Little Colorado, Agua Fria, Salt, and Verde River drainages	stocking	Agua Fria Salt Black Tonto Verde Little Col	spikedace loach minnow razorback sucker Gila topminnow Colorado squawfish bonytail chub Apache trout Little Colorado spinedace bald eagle	12-15-95	ongoing	FWS	AZFRO

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-94-I-386	INLAA	Baker's Pass Ecosystem Management Area (included Perkinsville, Horseshoe and Antelope Hills allotments)	grazing	Verde	spikedace razorback sucker bald eagle peregrine falcon	07-08-97[2] (date of FONSI)	ongoing	USFS	Prescott NF
part of 000089RO	INLAA	Antelope Hills and Perkinsville allotments - ongoing grazing			spikedace loach minnow razorback sucker Colorado squawfish bald eagle peregrine falcon MX spotted owl SW willow flycatcher	04-30-98[2]			
part of 2-22-99-F-016	INLAA				as above plus Gila topminnow	04-20-00[2]			
2-21-01-I-011	??	Antelope Hills and Perkinsville - term permit			SW willow flycatcher ch	??			
In consultation	??	Antelope Hills only Antelope Hills, Perkinsville, and Horseshoe			spikedace ch loach minnow ch	??			
2-21-95-F-399 2-21-95-F-500 2-21-95-F-732	INLAA	Windmill grazing allotment	grazing	Verde	spikedace (INLAA) loach minnow (INLAA) razorback sucker (NJ) AZ cliffrose (NJ) Gila trout (INLAA) SW willow flycatcher (INLAA) MX spotted owl (INLAA)	10-28-97	ongoing	USFS	Coconino NF

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-000098RO 2-21-97-F-416	NJ	11 Forest Plans	planning	Gila Salt Black White San Francisco Blue Eagle Bonita Tonto Verde Agua Fria San Pedro Aravaipa Santa Cruz Little Col.	spikedace loach minnow razorback sucker desert pupfish Gila topminnow Little Colorado spinedace Apache trout Chihuahua chub Gila trout Sonora chub Yaqui catfish Yaqui chub 13 plants 2 herps 3 birds 3 mammals	12-19-97	ongoing	USFS	RO
no number	INLAA	Red Creek grazing allotment	grazing	Verde	Gila topminnow SW willow flycatcher	??-??-98[2]	ongoing	USFS	Tonto NF, Cave Creek RD
part of 000089RO	INLAA				lesser long-nosed bat bald eagle MS spotted owl SW willow flycatcher	04-30-98[2]			
part of 2-22-99-F-416	LAA				spikedace (INLAA) loach minnow Gila topminnow razorback sucker(NLAA) lesser long-nosed bat (INLAA) MX spotted owl (INLAA) SW willow flycatcher	04-20-00[2]			
2-21-99-F-022	NJ				loach minnow Gila topminnow SW willow flycatcher cactus ferr. pygmy owl	12-19-00			

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-98-F-403	INLAA	State Route 260 widening and bridge construction Cottonwood to Camp Verde	bridge	Verde	loach minnow razorback sucker (NJ) SW willow flycatcher(NJ)	10-01-98 3-5-99 (BO)	??	FHWA	Phoenix
000089RO	NJ	Ongoing livestock grazing on 21 allotments Bear Valley Boneyard Buck Springs Bush Creek Chrysotile Colter Creek Cow Flat Dark Canyon Double Circles East Eagle Foote Creek Hickey Hicks/Pikes Peak Limestone Montana Mud Springs Nutrioso Pigeon Pleasant Valley Red Hill Sapillo Sardine Sears-Club/Chalk Mtn Sheep Spgs/Heber-Reno Sheep driveway South Escudilla Tule Wildbunch Williams Valley	grazing	Gila Eagle San Francisco Blue Black Salt Tonto Verde Little Col. Altar	spikedace loach minnow Gila topminnow Little Colorado spinedace Sonora chub razorback sucker peregrine falcon MX spotted owl lesser long-nosed bat AZ hedgehog cactus	02-02-99	ongoing	USFS	RO

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NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
000089RO continued	INLAA (for spikedace & loach minnow only)	13 Mile Rock Alexander Alma Alma waterlane Antelope Hills Apache Canyon Basin Beaver Creek Bee Springs Big Dry Black Bob Bobcat-Johnson Brown Springs Buckhorn Canyon Creek Cedar Breaks China Dam Chrysotile Citizen Colter Creek Copper Canyon Copper Creek Corduroy Corner Mountain Cow Creek Cow Flat Cross Bar Cross V Dark Canyon Deep Canyon Devil's Peak	grazing	Gila Eagle San Francisco Blue Black Salt Tonto Verde Little Col. Altar	spikedace loach minnow (many other species also were INLAA for these and other allotments)	04-30-98[2]	ongoing	USFS	RO

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
		Double Circles Dry Creek Eagle Peak East Eagle Fishhook Foote Creek Fossil Creek Frisco Plaza Gila River Govina Hackberry/Pivot Rock Harden Cienga Harve Gulch Haystack Butte Hickey Hicks-Pikes Peak Jerome Jordan Mesa Kelly Leggett Lightening Mesa Little Rough Luna Mangas Valley McCarty Mud Springs Negrito Perkinsville Pleasanton Pool Corral Red Creek							

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NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
		Red Hill Roberts Park Rudd Knoll Sardine Sedona Sedow Silverdale Squaw Peak Steeple-Mesa Stone Creek Strayhorse Taylor Tule Springs Upper Campbell Blue West Bear/Del Rio XSX Yeguas Young							
9-98-F-001	NJ	Army Corps of Engineers implementation of Nationwide permit 29 with the framework for development of Standard Local Operating Procedures - Endangered Species	many	all	all listed and proposed species	?? - ??-99	ongoing	COE	DC

Appendix 1 - SECTION 7 CONSULTATION HISTORY - SPIKEDACE, LOACH MINNOW, RAZORBACK SUCKER on Verde River**

NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
2-21-00-I-099	INLAA	Rio Salado Town Lake stocking of rainbow trout and roundtail chub	stocking	Salt Gila Verde Agua Fria Tonto Black Blue White San Fran. upper Gila Eagle Bonita San Pedro Santa Cruz	spikedace loach minnow Gila topminnow desert pupfish razorback sucker Colorado squawfish Gila chub Chiricahua leopard frog brown pelican Yuma clapper rail SW willow flycatcher cactus ferr. pygmy owl bald eagle	01-10-01	completed	FWS	Federal Aid
In consultation see also 000089RO and 2-22-99-F-016	?	Livestock grazing, ongoing and term permits, on 15 allotments on Prescott NF Antelope Hills Brown Springs China Dam Copper Canyon Horseshoe Jerome Limestone Muldoon Perkinsville Sand Flat Squaw Peak Sycamore Verde West Bear/Del Rio Young	grazing	Verde	spikedace ch loach minnow ch	?	In consultation	USFS	Prescott NF Chino Valley and Verde RDs
2-21-01-F-124	??	13-mile Rock allotment management plan	grazing	Verde	spikedace ch loach minnow ch	??		USFS	Coconino NF

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NUMBER	FINDING[1]	NAME	ACTION TYPE	SUB-BASIN	SPECIES	DATE OF FINDING	PROJECT STATUS	ACTION AGENCY	AGENCY SUBOFFICE
In consultation	?	grazing on Tonto NF	grazing	Salt Verde Tonto	spikedace ch loach minnow ch	?	In consultation	USFS	Tonto NF
In consultation	?	The Homestead Housing Development	housing	Verde	spikedace & ch loach minnow & ch razorback sucker & ch Colorado squawfish & ch SWwillow flycatcher &ch	?	In consultation	EPA	
This project	LAA NAM NLAA	Kellner jacks on Verde River	flooding	Verde	spikedace & ch loach minnow & ch razorback sucker & ch Colorado squawfish SWwillow flycatcher &ch	This project		NRCS	Phoenix

**Includes all biological opinions, known "is not likely to adversely affect" findings, and known "no effect" findings where significant effects to spikedace, loach minnow and razorback sucker may have occurred.

[1] (when multiple species are involved, this is the most restrictive finding for spikedace, loach minnow, or razorback sucker)
AM = adverse modification of critical habitat
BC = beneficial concurrence
CR = conference report
E = emergency
J = jeopardy
INLAA (or NLAA) = is not likely to adversely affect
LAA = likely to adversely affect
NAM = non-adverse modification of critical habitat
NC = nonconcurrence
NE = no effect
NJ = nonjeopardy

[2]This is the date of the biological assessment in which the USFS determined INLAA. These findings did not require concurrence from the FWS, but received a blanket concurrence or went through the grazing team, which did not document individual INLAA findings. The first blanket concurrence was on 05-05-95 and allotments for which this concurrence was used are generally not known. The second blanket concurrence was on 03-05-98 for ongoing grazing; the INLAA findings for this are documented in the USFS 04-30-98 and 09-29-98 biological assessments. The third blanket concurrence was on 09-10-98 and in a slightly different form on 09-18-98 for term grazing permits; the INLAA findings for this are documented in the USFS 04-20-00 biological assessment. In addition to the biological assessment INLAA findings, others were made verbally by the grazing team; no documentation is available for those.