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Cons. # 22420-2010-F-0090

Lesley A. McWhirter, New Mexico/Texas Branch Chief
Regulatory Division
Albuquerque District, Corps of Engineers
4101 Jefferson Plaza NE
Albuquerque, New Mexico 87109

Thank you for your request for formal consultation with the U.S. Fish and Wildlife Service (Service) on a permit (Corps Action No. SPA-2009-00544-ABQ) for the New Mexico Department of Transportation (NMDOT) (Applicant) under section 404 of the Clean Water Act. We received your letter on June 14, 2010, with a Biological Assessment (BA) evaluating the effects of the abutment repairs at the New Mexico Highway 15 (NM 15) Bridge on the West Fork Gila River (Project) on the threatened spikedace (*Meda fulgida*) and threatened loach minnow (*Tiaroga cobitis*), and their designated critical habitat. You determined that the Project "may affect, and is likely to adversely affect" both species and designated critical habitat. In addition, you determined that the Project "may affect, but is not likely to adversely affect" the threatened Chiricahua leopard frog (*Lithobates* [*Rana*] *chiricahuensis*), and requested concurrence. We concur with this determination based on the following reasons:

Chiricahua leopard frog

There are no collection records of Chiricahua leopard frog from the immediate vicinity of the action area. Although the project area contains suitable habitat, collection records are from upstream and east of the project area, the West Fork Gila River, Black Canyon confluence with East Fork Gila River Fork, and Links Ranch off the Middle Fork Gila River. These locations are greater than 8 kilometers (km) (5 miles [mi]), beyond the reasonable dispersal distance for Chiricahua leopard frog as defined by the Southwest Endangered Species Act Team (2008). In addition there are two museum records of Chiricahua leopard frog from the West Gila River Fork, White Creek Cabin, which is located 20.4 km (12.7 mi) west of the action area, and another, is from an unspecified location on the West Gila River Fork. Recent surveys, conducted by permitted and qualified Chiricahua leopard frog biologists, resulted in no observations of the species in the area, and the Project area is small; therefore, it is unlikely that the species will be in the immediate area. Additionally, heavy equipment will work in a small footprint within the channel that will be dewatered prior to constructions. As such, we anticipate that any effects to Chiricahua leopard frog will be insignificant or discountable.

The likelihood that Chiricahua leopard frog may be present during construction is very low. To ensure that effects to Chiricahua leopard frog are insignificant and discountable, the following conservation measures will be incorporated into the action:

1. a permitted frog biologist will thoroughly survey the area prior to implementation of the project;
2. the frog biologist will monitor the project to ensure no Chiricahua leopard frogs are present during construction;
3. cross-channel blocking nets will be used to prevent immigration of Chiricahua leopard frog into the work area prior to the implementation of abutment repairs; and
4. if Chiricahua leopard frogs of any stage are observed in the action area, all activities shall cease, and the Service will be notified immediately.

The NMDOT has also incorporated specific conservation measures to ensure that any effects from the action will be insignificant or discountable (see page 4). For these reasons, we concur that the Project "may affect, is not likely to adversely affect" the frog. This concludes consultation on the Chiricahua leopard frog.

We concur with your determination for the spikedace and loach minnow, and provide this biological opinion (BO) in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

Also note that this biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of designated critical habitat from 50 Code of Federal Regulations (CFR) 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in *Gifford Pinchot Task Force versus U.S. Fish and Wildlife Service* (Case No. 03-35279) to complete our analyses with respect to designated critical habitat.

Consultation History

Informal consultation was initiated on February 8, 2010, the Army Corps of Engineers requested us to attend a site visit to evaluate damage at the NM 15 Bridge near the Gila Cliff Dwellings. An on-site visit was conducted on March 24, 2010, to discuss damages to the bridge. Formal consultation was initiated on June 14, 2010. The U.S. Forest Service (Forest Service), New Mexico Department of Game and Fish (NMDGF), and Gila-Cliff Dwellings National Monument (Monument) were contacted because the proposed action may affect resources on lands under their jurisdiction. This BO is based on information provided in the BA, subsequent email and telephone conversations between our staff, and data in our files. We determined that the information in the BA was sufficient and adequate to complete formal consultation. A complete administrative record of this consultation is on file at this office.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action is located on the West Fork Gila River (River) near the Gila Cliff Dwellings National Monument in Catron County, New Mexico. The NM 15 Bridge is located at latitude 33.2259 and longitude -108.2514 (North American Datum of 1983). The bridge and supporting structure are on State of New Mexico lands under the jurisdiction of the NMDGF, but NMDOT has an easement agreement with NMDGF (NMDGF 2011a, b). NMDGF reviewed the proposed action through the NMDOT. The action area for the project does extend a short distance onto Forest Service lands. Because of the small indirect impact on Forest Service lands the Forest Service did not identify any impacts not addressed in this BO (Forest Service 2011). The action, repair of two abutments, extends approximately 15.2 meters (m) (50 feet [ft]) upstream and 15.2 m (50 ft) downstream from the center line of the bridge, plus an additional 51.8 m (170 ft) downstream beyond the Project area. Total length of stream habitat that could be impacted is 82.3 m (270 ft), and an approximate bank width is 33.5 m (110 ft), therefore the Project area is approximately 0.28 hectares (ha) (0.68 acres). The habitat includes 46 m^2 (500 ft^2) of pool habitat, 15 m^2 (160 ft^2) of run habitat, and 10 m^2 (106 ft^2) of riffle habitat available for spikedace and loach minnow (Pittenger 2010). In addition, up to 46 m^2 (500 ft^2) of sparse herbaceous vegetation on the floodplain would be temporarily impacted by operation of construction equipment and stockpiling of materials.

The River scours the NM 15 roadbed and bridge abutments during high flow events, and even during some average runoff events. According to NMDOT (2003), the approach roadway to the NM 15 Bridge has failed four times and there have been numerous problems requiring maintenance activities since it was built in 1966. Erosion occurs on outer turns of the River's meanders and erodes the roadbed and bridge fill material. A more natural channel pattern, with vegetated point bars and a developed floodplain cannot be realized because the historical floodplain has been constricted by the road, NM 15 Bridge, and other developments (e.g., campgrounds). Local abutment scour is accentuated by debris buildup and stream instability, which shifts the stream and changes the angle of flow as the river approaches the bridge. Abutment scour also occurs around the wing walls and abutment footing, subsequently scouring the approach fill material.

A flood event occurred in January 2008 that had a recurrence interval of 20.5 years, based on an analysis of annual peak flows from 1928 through 2008 recorded at the Gila River gage near Gila, New Mexico (U.S. Geological Survey [USGS] gage 09430500). The flood washed out a section of the NM 15 roadway on the north side of the bridge and removed or damaged wire-enclosed riprap at the north and south bridge abutments. The wire-enclosed riprap was originally place at the abutments to protect the bridge pilings from scour and undermining. The Project is intended to repair the damage to the abutments that occurred during the January 2008 flood. Without these repairs, the bridge piers would remain exposed and be vulnerable to undermining and failure, which would compromise the integrity of the bridge and making this the fifth failure since 1966.

The NMDOT proposes to place wire-enclosed riprap at the north and south abutments of the bridge to repair damage that occurred. The Project will be completed one abutment at a time. The work area around the abutments would be enclosed a using concrete wall barrier and fill material, which would serve to divert stream flow around the site. A 46-centimeter (cm) (18-inch [in]) thick layer of wire-enclosed Class A riprap would be installed on the abutment slope, extending down to the bottom of the footing trench. Work will involve operation of backhoe on the floodplain and below the ordinary high water mark of the River for removal of loose debris and fill and excavation of footing trenches at both abutments. A front-end loader will be operated on the floodplain and below the ordinary high water mark to place fill and riprap.

Approximately 1,774 cubic meter (m^3) (2,320 cubic yards [yd^3]) of materials will be excavated, backfilled, and compacted at the north abutment to reconstruct the abutment slope. Following replacement and compaction of abutment fill, 841 m^3 (1,100 yd^3) of 46-cm thick wire-enclosed Class A riprap would be placed at the abutments.

On the south side of the bridge 115 m^3 (150 yd^3) of materials will be excavated, backfilled, and compacted at the north abutment to reconstruct the abutment slope. Following replacement and compaction of abutment fill, 153 m^3 (200 yd^3) of 46-cm thick wire-enclosed Class A riprap would be placed at the abutments.

Fish and amphibians will be salvaged from the Project area and translocated upstream. This will be accomplished by enclosing the Project area with block nets at the upstream and downstream ends and then capturing fish and amphibians in the work area using multiple-pass electrofishing and seining. All fish captured would be relocated upstream of the Project area. The block nets would remain in place during project implementation to prevent fish from reentering the work area.

In addition, NMDOT will perform riparian restoration to include the planting of 0.8 ha (2.0 acres) of willow (*Salix* spp.) clusters and cottonwood (*Populus* spp.) poles in the northwest quadrant of the bridge crossing. This will be part of a separate project to promote bank stabilization and habitat enhancement within the general Project area. This project will also include approximately 12 ha (30 acres) of wetland and riparian habitat restoration that will have a separate consultation.

Conservation measures

Conservation measures proposed by the applicant include:

1. all work will be conducted during low-flow conditions. Flow will be diverted around the in-channel work area using concrete wall barriers;
2. all work will be conducted before April or after June, outside of the spawning period of spikedace and loach minnow;
3. a block net will be installed upstream and downstream of the Project area during

construction to exclude fish and amphibians;

4. fish and amphibians will be salvaged from the Project area and translocated upstream, outside the action area;
5. The Chiricahua leopard frog can only be translocated by a certified frog biologist that is permitted to collect and translocate (Note: prior to collection or translocation contact USFWS);
6. spill response materials, such as booms and absorbent pads, will be available on-site at all times during the Project; all spills will be reported to appropriate agencies;
7. all fuels, lubricants, equipment, and other materials that may contaminate surface water will be stored outside of the 100-year floodplain;
8. to prevent the introduction of invasive species seeds, all earthmoving and hauling equipment will be washed prior to entering the Project area;
9. to prevent invasive species seeds from leaving the site, all construction equipment will be inspected and all attached plant/vegetation and soil/mud debris removed prior to leaving the Project area;
10. heavy equipment used in the stream will be steam cleaned to remove petroleum products (oil, grease, and hydraulic fluids) before being used in the Project area, to reduce the potential for adverse effects from petroleum products in the River; and
11. the Project will adhere to all terms and conditions under the Clean Water Act, such as the U.S. Army Corps of Engineers 404 permit and the 401 water quality certification from the New Mexico Environment Department.

STATUS OF THE SPECIES AND CRITICAL HABITAT (rangewide)

Spikedace

Status of the species/critical habitat

Spikedace was listed as a threatened species under the Act on July 1, 1986, based on the reduction of range and numbers due to habitat destruction and competition with nonnative fishes (Service 1986a). The Service found that a petition to reclassify both species to endangered status was warranted, however, reclassification was precluded due to work on other higher priority listing actions (Service 1994c). The need for reclassification is based on threats to a large portion of its habitat. Spikedace is listed as endangered by the State of New Mexico (NMDGF 2006) and is considered a wildlife of special concern in Arizona (Arizona Game and Fish Department [AGFD] 1996). A recovery plan for spikedace was published in 1991 (Service 1991a).

The Service designated critical habitat for spikedace in 1994, which included portions of the San Francisco, Tularosa, upper Gila River, Aravaipa Creek, and the Blue River from Campbell and Dry Blue Creeks downstream to the confluence with the San Francisco River in Arizona and New Mexico (Service 1994a). Designated critical habitat for the spikedace and loach minnow was set aside by the New Mexico District Court (*Coalition of Arizona-New Mexico Counties for Stable Economic Growth versus U.S. Fish and Wildlife Service*, No. 95-1285-M Civil D.N.M., filed March 4, 1997). The court cited the Service's failure to analyze the effects of critical habitat designation under the National Environmental Policy Act as the basis for its ruling. Designated critical habitat was revoked by the Service on March 25, 1998 (Service 1998). The Service published a new critical habitat proposal in the Federal Register on December 10, 1999 (Service 1999), and a final rule was published on April 25, 2000 (Service 2000). On June 1, 2004, the United States District Court for the District of New Mexico ruled that critical habitat for spikedace be vacated. Critical habitat was proposed again in 2005 and designated on March 21, 2007 (Service 2007). Following a legal challenge to that designation, the Service filed a motion for voluntary remand and is currently reevaluating critical habitat. However, those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized (Service 2010).

Description of the species

Spikedace is a member of the minnow family Cyprindae. Adult spikedace are 63 to 75 millimeters (mm) (2.5 to 2.9 in) in length (Sublette et al. 1990). The eyes are large, the snout pointed, and the mouth slightly subterminal with no barbels present. The species is slender and slightly compressed laterally. Scales are present only as small deeply embedded plates. The first spinous ray of the dorsal fin is the strongest and most sharply pointed. Spikedace are olive-gray to light brown above, with brilliant silver sides and black specks and blotches on the back and upper side. Breeding males have brassy-yellow heads and fin bases (Minckley 1973).

Life history and habitat description

Spikedace occupy midwater habitats, usually less than 30 cm (12 in) deep, with slow to moderate water velocities over sand, gravel, and cobble substrates (Sublette et al. 1990). Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (Propst et al. 1986). The preferred habitat of spikedace varies, shifting both seasonally and with maturation (Propst et al. 1986). Geographic differences in use of microhabitat have been noted, with populations in the forks area of the Gila drainage occupying deeper, slower velocities than more downstream populations. Likewise, seasonal shifts in microhabitat have been noted in the upper Gila drainage, with populations seeking shallower habitats (less than 16.8 cm [6.6 in]) in the winter and deeper water (16.8 to 32.1 cm [6.6 to 12.6 in]) during warmer months (Sublette et al. 1990). In winter, the species congregates along stream margins with cobble substrates.

The erratic flow patterns of southwestern streams that include periodic spates and recurrent flooding are essential to the feeding and reproduction of spikedace by scouring the sands and keeping gravels clean (Propst et al. 1986). Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats. The young typically occupy stream margin habitats, where the water velocity is less than 5 cm per second (cm/s) (0.2 ft/s) and the depth is less than 5 cm (2 in). Juveniles are also found at depths of 32 cm (12.6 in) or less, but utilize gravel/sand substrates and a wider range of water velocity than do larvae (Propst et al. 1986).

Spikedace live approximately 2 years, with reproduction occurring primarily in 1-year-old fish (Barber et al. 1970; Anderson 1978; Propst et al. 1986). Spawning extends from mid-March into

June and occurs in shallow (less than 15 cm [5.9 in]) riffles with gravel and sand bottoms and moderate flow (Barber et al. 1970; Anderson 1978; Propst et al. 1986). By mid-May, most spawning has occurred, although in years of high-water flows, spawning may continue into early June (Propst et al. 1986). Younger females spawn once per year and older females twice. Reproduction is apparently initiated in response to a combination of declining stream discharge and increasing water temperature. Males move about the spawning riffles without exhibiting aggression, awaiting females ready to spawn (Barber et al. 1970). Females enter spawning sites from adjacent pools, slow velocity areas, or from downstream, and are met by two or more patrolling males and herded toward the bottom where spawning occurs. After spawning, the males return to patrol the area while the female moves downstream. Gametes are presumably expelled into the water column. The eggs are heavy, sink, and adhere to the substrate. Fecundity of individual females based on gonad examination ranges from 90 to 250 ova, and is significantly correlated with both length and age (Service 1991a).

The young grow rapidly, attaining a length of 35 to 40 mm (1.4 to 1.6 in) by November of the year spawned. Based on length-frequency analyses, the maximum longevity is approximately 2 years, although few survive more than 1 year (Propst et al. 1986). Sex ratio among reproductive adults is not constant, varying from an about equal number of males and females among younger fish to a greater abundance of females among older fish (Service 1991a).

Spikedace feed primarily on aquatic and terrestrial insects (Barber and Minckley 1983; Propst et al. 1986; Marsh et al. 1989). In addition, Barber et al. (1970) report that they feed on items in the drift including some fish fry. Diet composition is largely determined by type of habitat and time of year (Minckley 1973). Propst et al. (1986) report that spikedace from the Gila-Cliff Valley feed on mayflies, true flies, and caddisflies. The general lack of terrestrial invertebrates in spikedace stomachs indicated that the species is very dependent upon aquatic insects for sustenance (Propst et al. 1986).

Population dynamics

Spikedace has low population numbers, short life expectancy, and low fecundity. These factors combined make spikedace very sensitive to adverse environmental changes and disturbances. Based on long-term survey results, it appears that spikedace populations are highly variable. Population numbers may be high in one year and very low the following year (NMDGF 2004). In Eagle Creek, Arizona, the species was thought to be extirpated but then was collected in relatively high numbers in 1987. It is not known if population fluctuations are due to variation in environmental conditions or intrinsic (demographic) population variability.

Population status and distribution

Since the 1800s, spikedace has declined markedly in distribution and abundance throughout its range (Propst et al. 1986; Service 1986a). Spikedace populations appear to be declining rangewide. Historically, spikedace occurred in the Agua Fria, Verde, Salt, San Pedro, San Francisco, and Gila drainages in Arizona and throughout the Gila River and its tributaries (e.g., San Francisco River, West, East, and Middle Forks Gila River) in New Mexico. By 1996, spikedace had been eliminated from over 85 percent of its historical range (NMDGF 1996). By

2004, there were only two remaining stronghold reaches for the species, 21 km (13 mi) of Aravaipa Creek in Arizona and an 11 km (7 mi) segment of the Gila River at the Gila Bird Area (Paroz and Propst 2007).

Spikedace is found in low numbers in other locations of the Gila River, but its numbers have been declining since 2000 (Propst 2006). It has been extirpated from the San Francisco and Tularosa Rivers in New Mexico. In Arizona it has been extirpated from Agua Fria, Salt, Tonto, San Pedro, and Gila Rivers (Desert Fishes Team 2003), and has not been found recently in the Verde River (Arizona State University 2002). However, absence in sample collections does not necessarily mean extirpation. On Eagle Creek spikedace were not found in collections made in 1950, but then appeared in collections in 1986, and was relatively common in collections made in 1987 (Arizona State University 2002).

Recent taxonomic and genetic work on spikedace indicates there are substantial differences in morphology and genetic makeup among drainage basins. Anderson and Hendrickson (1994) found that spikedace from the Verde River are morphologically distinguishable from all other spikedace populations, being the most distinct from spikedace in Aravaipa Creek, while spikedace from the upper Gila River and Eagle Creek populations have intermediate levels of variation. Mitochondrial DNA and allozyme analyses have revealed similar patterns of geographic variation within the species (Tibbets and Dowling 1996). Protection of isolated spikedace populations is important to preserve genetic variation.

During the last century, habitat destruction, competition and predation by nonnative aquatic species have reduced the historical range of the spikedace (Miller 1961; Hendrickson and Minckley 1984; Williams et al. 1985; Service 1986a; Marsh et al. 1989; Service 1994a). Both historical and present landscapes surrounding spikedace habitats have been impacted to varying degrees by domestic livestock grazing, mining, agriculture, timber harvest, wildfire, recreation, development, or impoundments (Hendrickson and Minckley 1984; Belsky et al. 1999). Detrimental land and water use practices have impaired perennial flows and natural hydrographs (Minckley and Meffe 1987). These activities degrade spikedace habitats by altering flow regimes, increasing watershed and channel erosion, contributing to increased sedimentation, and adding contaminants to streams and rivers (Belsky et al. 1999; Donahue 2000). Alteration of the natural flooding characteristic of desert streams has degraded habitat and increased competition from introduced nonnative species (Minckley and Meffe 1987). As a result, these activities may affect spikedace through direct mortality, interference with reproduction and predator avoidance, fragmentation of populations, and reduction of invertebrate food supplies.

Nonnative aquatic species (fishes, bullfrogs, and crayfish) are a threat to spikedace as they are for most native aquatic fishes. Of the 40 species and subspecies of fish that have gone extinct in North America, the detrimental effects of introduced species were cited in 68 percent of the extinctions (Miller et al. 1989). Red shiner (*Cyprinella lutrensis*), in particular, is frequently cited in the decline of spikedace (Minckley and Deacon 1968; Minckley 1973). Red shiner out competes spikedace for food and habitat, and is very tolerant of the extreme conditions found in desert streams (Matthews and Hill 1977). Nonnative fish such as channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*) frequent riffles occupied by spikedace, especially at night when they move onto riffles to feed, and may prey on spikedace (Propst

1999). In addition largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), introduced trout, and bullfrogs (*Lithobates catesbeianus*) may prey on spikedace.

Past changes in the range and population density of spikedace undoubtedly occurred in response to natural spatial and temporal variations in the environment, but their current threatened status is the result of direct, indirect, and cumulative effects of human activities. The Gila River basin is generally in a degraded condition with poor riparian habitats, incised channels, poor bank stability, and high streambed embeddedness (Propst et al. 1986).

Designated Critical Habitat

The critical habitat designation for spikedace is separated into five complexes, which were based on sufficient primary constituent elements (PCEs) include the Verde River, Black River, Middle Gila/Lower San Pedro/Aravaipa Creek, San Francisco/Blue River, and Upper Gila River. Designations were based on sufficient PCEs being present to support one or more the species' life history functions. The PCEs of critical habitat designated for spikedace are as follows (Service 2007):

1. permanent, flowing water with no or minimal levels of pollutants;
2. sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness;
3. streams that have low gradients, appropriate water temperatures, pool, riffle, run, and backwater components, and abundant aquatic food base;
4. habitat devoid of nonnative aquatic species or habitat in which nonnative aquatic species are at levels that allows persistence of spikedace; and
5. areas within perennial, interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied habitat and through which the species may move when the habitat is wetted.

Currently, there is approximately 12.4 km (7.7 mi) of designated critical habitat for the West Fork Gila River from the confluence of the East Fork Gila River, 226.3 km (140.6 mi) within the Upper Gila Complex (Service 2007). Refer to the Service (2007) for more specific information on the spikedace PCEs and designated critical habitat.

Designated critical habitat is proposed to be changed to approximately 13.0 km (8.1 mi) for the West Fork Gila River from the confluence with the East Fork Gila River, 248 km (154 mi) within Gila River Subbasin (Service 2010).

Loach minnow

Status of the species/critical habitat

Loach minnow was listed as a threatened species on October 28, 1986, based on the reduction of its range and numbers due to habitat destruction and competition with nonnative fish species (Service 1986b). The Service found that a petition to reclassify the species to endangered status was warranted; however, reclassification was precluded due to work on other higher priority listing actions (Service 1994c). The need for reclassification is based on threats to a large portion of its habitat. The species is listed as threatened by the State of New Mexico (NMDGF 1996) and Wildlife of Special Concern in Arizona (AGFD 1996). The Service published the loach minnow recovery plan in 1991 (Service 1991b).

The Service designated critical habitat for loach minnow in 1994, which included portions of the San Francisco, Tularosa, upper Gila Rivers, Aravaipa Creek, and the Blue River from Campbell and Dry Blue Creeks downstream to the confluence with the San Francisco River (Service 1994b). Critical habitat for the loach minnow was set aside by the New Mexico District Court (*Coalition of Arizona-New Mexico Counties for Stable Economic Growth vs. U.S. Fish and Wildlife Service*, No. 95-1285-M Civil D.N.M., filed March 4, 1997). The court cited the Service's failure to analyze the effects of critical habitat designation under the National Environmental Policy Act as the basis for its ruling. Critical habitat was revoked by the Service on March 25, 1998 (Service 1998). The Service published a new critical habitat proposal in the Federal Register on December 10, 1999 (Service 1999), and a final rule was published on April 25, 2000 (Service 2000). On June 1, 2004, the United States District Court for the District of New Mexico ruled that critical habitat for loach minnow was vacated. Critical habitat was proposed again in 2005 and designated on March 21, 2007 (Service 2007). Following a legal challenge to that designation, the Service filed a motion for voluntary remand and is currently reevaluating critical habitat. However, those areas designated as critical habitat in the 2007 rule remain in place until a new designation can be finalized (Service 2010).

Species Description

The loach minnow is a small, slender, elongate fish of the family Cyprinidae rarely exceeding 60 mm (2.4 in) in length (Minckley 1973). The eyes are directed upward and the mouth is terminal with no barbels. Loach minnow have an olivaceous coloration that is highly blotched with darker pigment. Whitish spots are present at the origin and insertion of the dorsal fin as well as the dorsal and ventral portions of the caudal fin base. Breeding males develop bright red-orange coloration at the bases of the paired fins, on adjacent fins, on the base of the caudal opening, and often on the abdomen. Breeding females become yellowish on their fins and lower body (Minckley 1973).

Life history and habitat description

Loach minnow is found in turbulent, rocky riffles of streams up to about 2,200 m (7,200 ft) in elevation. Loach minnow are bottom-dwelling inhabitants of shallow, swift waters flowing over gravel, cobble, and rubble substrates in mainstream rivers and tributaries (Rinne 1989; Propst and Bestgen 1991). In addition, the species is very habitat specific, only inhabiting riffles; this limited habitat is vulnerable to the adverse effects of sedimentation. These factors make the loach minnow very sensitive to environmental changes and disturbances. Loach minnow use the spaces between, and in the lee of, larger substrates for resting, sheltering, feeding, and spawning (Propst et al. 1988; Rinne 1989). The species is rare or absent from habitats where fine sediments fill interstitial spaces (Propst and Bestgen 1991).

Most growth occurs during the first summer. Longevity is typically 15 months to 2 years, although loach minnow can live as long as 3 years (Britt 1982; Propst et al. 1988; Propst and Bestgen 1991). The first spawn generally occurs in their second year, primarily during March through May (Britt 1982; Propst et al. 1988), however, under certain circumstances, loach minnow also spawn in the autumn (Vives and Minckley 1990). Miller (1998) reports loach minnow males in New Mexico were in breeding coloration in late June.

Spawning occurs in the same riffles occupied by adults during the nonspawning season. Sex ratios appear approximately equal (Service 1991b). The adhesive eggs of the loach minnow are attached to the undersurface of the downstream side of a rock that forms the roof of a small cavity in the substrate. Rocks used for spawning are flattened and slightly elevated from the stream bottom on the downstream side and are nearly always fine-grained, basalt-type material with smooth surfaces; coarse-grained stones with pocked or rough surfaces are not used for ova deposition (Propst and Bestgen 1991). To be suitable for loach minnow spawning, cobbles need to be anchored in the substrate. The number of eggs deposited per rock ranges from 4 to 260, with reported means of 52 (Propst and Bestgen 1991) and 63 (Britt 1982). Fecundity of females ranges from about 150 to 250 mature ova, and generally increases with increasing size (Service 1991b). Eggs incubated at 18 to 20 degrees Celsius (°C) (64.4 to 68 degrees Fahrenheit [°F]) hatched in 5 to 6 days (Propst et al. 1988). Limited data indicate that the male loach minnow may guard the nest during incubation (Propst et al. 1988; Vives and Minckley 1990). Embryos are found on rocks 3 to 5 by 10 to 18 cm (1 to 2 by 4 to 7 in) located in riffles (Britt 1982; Propst and Bestgen 1991).

Loach minnow feed exclusively on aquatic insects (Britt 1982; Barber and Minckley 1983; Abarca 1987). Loach minnow are opportunistic benthic insectivores, feeding primarily on riffle-dwelling larval mayflies, black flies, and chironomids. They actively seek their food among bottom substrates, rather than pursuing food items in the drift.

Population dynamics

The loach minnow has low population numbers, short life expectancy, and low fecundity. Even in optimal habitat, loach minnow populations are not dense; Propst and Bestgen (1991) reported that estimated densities in optimal riffle habitat ranged from 1.65 per m^2 (0.15 per ft^2) to less than 0.5 per m^2 (0.04 per ft^2).

Population status and distribution

The loach minnow is endemic to the Gila River basin of Arizona and New Mexico, and Sonora, Mexico. In Arizona, the loach minnow occupied as many as 2,250 km (1,400 mi) of stream length, but it is now found in less than 10 percent of that range (Propst et al. 1988). Currently in Arizona, the loach minnow is generally rare to uncommon. Present populations are geographically isolated and inhabit upstream areas of their historical range, which included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila Rivers (Minckley 1973; Sublette et al. 1990). The species is believed to be extirpated from Mexico. In New Mexico, the loach minnow was historically found throughout warmwater reaches of the San Francisco and Gila Rivers and their major tributaries (Propst et al. 1988). The species has become very rare in substantial portions of its remaining range in New Mexico, and now occupies only fragmented reaches of the San Francisco and Gila drainages (Propst et al. 1988). The loach minnow is currently moderately common in less than 10 km (6.2 mi) of the Tularosa and San Francisco Rivers (NMDGF 2000). In the lower reaches of the West Fork Gila River, a small population persists and the population in the Gila-Cliff Valley has declined considerably in the past 15 years (NMDGF 2000; Propst 2004). Elsewhere in the Gila-San Francisco drainage, loach minnow occurs irregularly or is absent (NMDGF 2000). The loach minnow is one of the rarest of the remaining five species of native fishes inhabiting the Gila River and its tributaries (Propst 2002).

Biochemical investigations on this species indicates that there are substantial differences in genetic makeup between the remnant loach minnow populations that occupy isolated fragments of the Gila River basin, indicating a geographic component to the population structure of the species (Tibbets and Dowling 1996). Therefore, protection of isolated loach minnow populations is important to preserve genetic variation.

During the last century, loss of habitat, competition and predation by nonnative aquatic species have reduced the historical range of the loach minnow by about 85 percent (Miller 1961; Hendrickson and Minckley 1984; Williams et al. 1985; Service 1986b; Marsh et al. 1989; Service 1994b). Both historical and present landscapes surrounding loach minnow habitats have been impacted to varying degrees by livestock grazing, mining, agriculture, timber harvest, wildfire, recreation, development, or impoundments (Hendrickson and Minckley 1984; Belsky et al. 1999). Land and water use practices have impaired perennial flows and natural hydrographs (Minckley and Meffe 1987). These activities can degrade loach minnow habitats by altering flow regimes, increasing watershed and channel erosion, contributing to increased sedimentation, and adding contaminants to streams and rivers (Belsky et al. 1999; Donahue 2000). Alteration of the natural flooding characteristic of desert streams has degraded habitat and increased competition from introduced nonnative species (Minckley and Meffe 1987). As a result, these activities may affect loach minnow through direct mortality, interference with reproduction and predator avoidance, and reduction of invertebrate food supplies.

Nonnative aquatic species (fishes, bullfrogs, and crayfish) are a threat to loach minnow as they are for most native aquatic fishes. Of the 40 species and subspecies of fish that have gone extinct in North America, the detrimental effects of introduced species were cited in 68 percent of the extinctions (Miller et al. 1989). Red shiner competes with loach minnow for food and habitat and is very tolerant of the extreme conditions found in desert streams (Matthews and Hill 1977). Nonnative fish such as channel catfish and flathead catfish frequent riffles occupied by loach minnow, especially at night when catfish move onto riffles to feed and may prey on loach minnow (Propst 1999). In addition largemouth bass, smallmouth bass, green sunfish, introduced trout, and bullfrogs may prey on loach minnow.

Past changes in the range and population density of loach minnow undoubtedly occurred in response to natural spatial and temporal variations in the environment, but their current threatened status is the result of direct, indirect, and cumulative effects of human activities. The

Gila River basin is generally in a degraded condition with poor riparian habitats, incised channels, poor bank stability, and high streambed embeddedness (Propst et al. 1988).

Designated Critical Habitat

The critical habitat designation for loach minnow is separated into five complexes, which were based on sufficient primary constituent elements (PCEs) include the Verde River, Black River, Middle Gila/Lower San Pedro/Aravaipa Creek, San Francisco/Blue River Complex, and Upper Gila River. Designations were based on sufficient PCEs being present to support one or more the species' life history functions. The PCEs of critical habitat designated for loach minnow are as follows (Service 2007):

1. permanent, flowing water with no or minimal levels of pollutants;
2. sand, gravel, and cobble substrates with low or moderate amounts of fine sediment and substrate embeddedness;
3. streams that have low gradients, appropriate water temperatures, pool, riffle, run, and backwater components, and abundant aquatic food base;
4. habitat devoid of nonnative aquatic species or habitat in which nonnative aquatic species are at levels that allows persistence of loach minnow; and
5. areas within perennial, interrupted stream courses that are periodically dewatered but that serve as connective corridors between occupied habitat and through which the species may move when the habitat is wetted.

Currently, there is approximately 12.4 km (7.7 mi) of designated critical habitat for the West Fork Gila River from the confluence of the East Fork Gila River, and 226.3 (140.6 mi) within the Upper Gila Complex (Service 2007). Refer to Service (2007) for more specific information about the loach minnow PCEs and designated critical habitat.

Designated critical habitat is proposed to change to approximately 13.0 km (8.1 mi) for the West Fork Gila River from the confluence with the East Fork Gila River, 248 km (154 mi) within Gila River Subbasin (Service 2010).

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the Act, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the Act (50 CFR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone section 7 consultation, and the impacts of State and private actions that are contemporaneous with the consultation in progress. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation. We have defined the action area for this Project to include an area 15.2 m (50 ft) upstream from the center line of the bridge, plus an additional 67.1 m (220 ft) below the center line of the NM 15 Bridge.

Status of the Species within the Action Area

Spikedace

The West Fork Gila River watershed harbors one of the few remaining populations of spikedace left in New Mexico (NMDGF 2000). However, surveys conducted just upstream of the action area from 1989 to 2004 have shown a marked decline in population number (Propst 2004). From 1989 to 1995 the average number of spikedace caught during annual surveys at the Gila Cliff Dwellings site was 122 (range 49-341) and density equaled 0.18 per m^2 (1.9 per ft^2) (NMDGF 2004). From 1996 to 2004, the average was 8 (range 0-19) and the density dropped to 0.019 per m^2 (0.2 per ft^2) (NMDGF 2004). Only one was caught in 2003 and none were caught in 2004 in this area that was once considered a stronghold for the species (NMDGF 2004). In recent sampling efforts the greatest numbers of spikedace were collected from the Gila River near the Gila Bird Area (Paroz and Propst 2007).

Loach minnow

Although loach minnow were not as abundant at the Gila Cliff Dwellings site as spikedace, they have shown a similar, declining trend. From 1989 to 1995, the average number of loach minnow caught per year was 16.8, and density was 0.03 per m^2 (0.32 per ft^2) (NMDGF 2004). From 1996 to 2004 the average number of loach minnow caught was 1.7 and the density was 0.009 per m^2 (0.97 per ft^2), in those years loach minnow were caught (NMDGF 2004). There was an appreciable decline in numbers caught beginning in 1999. One loach minnow was caught in annual sampling in 1999 and 2001. None were caught in 2000 and 2002 to 2004 (NMDGF 2010). In addition loach minnow are sporadically collected in the Gila River Forks area (Paroz and Propst 2007). In general, the range and abundance of both spikedace and loach minnow have drastically declined over the last 30 years (Paroz and Propst 2007).

The action area includes approximately 0.08 km (0.05 mi) of designated critical habitat in the Upper Gila Complex.

Factors affecting the Species Environment within the Action Area

The West Fork Gila watershed is approximately 52,226 ha (130,566 acres), of which approximately 98 percent (50,981 ha [127,454 acres]) is in the Gila Wilderness. Land ownership is 51,588 ha (128,970 acres) National Forest lands; 210 ha (526 acres) National Park Service lands; and 428 ha (1070 acres) non-Federal lands. The following activities currently occur or have occurred in the past within the West Fork Gila watershed (Pittenger 2002):

1. highway construction and maintenance;
2. recreation facility development and recreational use;
3. introduction of nonnative aquatic species;
4. grazing;
5. timber harvest; and
6. wildfires, fire suppression, and wildfire use fires.

In addition, the Southwest, including the Gila basin has been experiencing a long-term drought that also may be affecting the species. The effects of all these activities contribute to the current riparian and watershed condition, which are discussed below.

Road and Bridge maintenance

NM 15 the primary means of access to the Gila-Cliff Dwellings National Monument, a major tourist destination. The West Fork Gila River runoff events scour the NM 15 roadbed and bridge abutments resulting in 8 recent repairs. Erosion occurs on outer meanders of the River and erodes the roadbed and bridge fill material. The scouring requires repetitive work in the River to maintain the integrity of the Bridge. Each time the highway or bridge approach washes out, turbidity is temporarily increased due to emergency repair work (Forest Service 2002).

Recreation

The following recreational infrastructure has been constructed in the vicinity of the action area to access the Gila National Forest: TJ Woody's Corral and West Fork trailheads; contact station and utilities; Scorpion Picnic area; and Scorpion campgrounds. The presence of recreational facilities does not allow the River to move within its floodplain without threatening the infrastructure. Consequently, there is a continual effort to armor the Bridge to protect it from scouring.

Nonnative species

Competition and predation by nonnative fishes, bullfrogs, and crayfish are thought to be one of the primary causes for the decline of native species (Miller 1961). Many nonnative fish have been introduced into the Gila River including red shiner, channel catfish, flathead catfish, black and yellow bullheads (*Ameiurus melas* and *Ameiurus natalis*), and western mosquitofish (*Gambusia affinis*) (Propst et al. 1986; Bestgen and Propst 1989). Smallmouth bass and largemouth bass are locally common. Due to declining native trout populations, the State of New Mexico propagated and stocked rainbow trout (*Oncorhynchus mykiss*), cutthroat trout (*Oncorhynchus clarkii*), and brown trout (*Salmo trutta*) during the early 1900s on the Gila National Forest to improve angler success. After early stocking programs were discontinued the nonnative trout species persisted and overlap in distribution with spikedace and loach minnow. Brown trout in particular, are piscivorous and may prey on native cyprininds.

At the Gila Cliff Dwellings site, the percent of native fishes was over 95 percent for 12 of 15 years and in only 1 year did it fall below 90 percent (to 89.2 percent) (Propst 2004). Nonnative fishes are unlikely the cause of the decline in native fishes at this site.

Livestock grazing

In the late 1800s and early 1900s, livestock grazing was uncontrolled and unmanaged over many of the watersheds that contain spikedace and loach minnow and much of the landscape was denuded of vegetation (Rixon 1905; Duce 1918; Leopold 1921; Leopold 1924; Ohmart 1996). Heavy livestock grazing has been shown to increase soil compaction, decrease infiltration rates, increase runoff, change vegetative species composition, decrease riparian vegetation, increase stream sedimentation, increase stream water temperature, decrease fish populations and change channel form (Meehan and Platts 1978; Kauffman and Kruger 1984; Schulz and Leininger 1990; Platts 1991; Fleischner 1994; Ohmart 1996). One or several of these factors in combination may have affected spikedace and loach minnow populations historically.

Livestock grazing on the Glenn Allotment, upstream of the action area, ceased in 1957. Livestock grazing on the Redstone Allotment, downstream of the action area, ceased around 1998. In 1988, the XSX Allotment, also downstream of the action area, changed from year-long grazing to intermittent grazing. Currently no livestock graze in the watershed upstream of the action area. Although livestock grazing within watersheds where spikedace and loach minnow and their designated critical habitat are located is less than in the past it continues to cause adverse effects. These adverse effects occur through watershed alteration and subsequent changes in the natural hydrograph, sediment production, and stream channel morphology (Platts 1991; Belsky et al. 1999; Service 2001).

Timber harvest

Logging activities in the early to mid 1900s likely caused major changes in watershed characteristics and stream morphology (Chamberlin et al. 1991). Rixon (1905) reported the occurrence of small timber mills in numerous canyons of the upper Gila River drainage. Early logging efforts were concentrated along canyon bottoms, often with perennial streams. Tree removal along perennial streams within the historical range of spikedace and loach minnow likely altered water temperature regimes, sediment loading, bank stability, and availability of large woody debris (Chamberlin et al. 1991). Timber harvest has not occurred on Federal land within the watershed since the passage of the Wilderness Act in 1964.

Fire

Severe wildfires capable of extirpating or decimating fish populations are a relatively recent phenomenon, and result from the cumulative effects of historical or ongoing grazing (removal of fine fuels needed to carry fire) and fire suppression (Madany and West 1983, Savage and Swetnam 1990; Swetnam 1990; Touchan et al. 1995; Swetnam and Baisan 1996; Belsky and Blumenthal 1997; Gresswell 1999). Historical wildfires were primarily cool-burning understory fires with return intervals of 3-7 years in ponderosa pine (*Pinus ponderosa*) (Swetnam and Dieterich 1985). Cooper (1960) concluded that prior to the 1950s; crown fires were extremely rare or nonexistent in the region. High-severity wildfires, subsequent floods and ash flows, have caused the extirpation of several populations of Gila trout (*Oncorhynchus gilae*) since 1989 (Propst et al. 1992; Brown et al. 2001) but effects on spikedace and loach minnow are not known.

During the past 50 years, fires of all sizes have burned in the West Fork Gila River watershed. From 1974 until 2001, approximately 24,000 ha (60,000 acres) burned and naturally revegetated. The watershed has had two large fires in the last 15 years. The Langstroth Fire burned approximately 2,000 ha (5,000 acres) in 1995 and the Lilley Fire burned approximately 400 ha (1,000 acres) in 1997. Both of these fires burned mostly with low to moderate intensity. In 2003, over 81,000 ha (200,000 acres) burned in the Gila National Forest (Service 2005). The most recent fire was the Meason fire located within the Aldo Leopold Wilderness, Gila National Forest covered 2,855 ha (7,055 acres).

Effects of fire may be direct and immediate or indirect and sustained over time (Gresswell 1999). Because spikedace and loach minnow are found primarily in the lower elevation, higher-order streams, they are most likely affected by the indirect effects of fire (e.g., ash flows), not direct effects (e.g., drastic changes in pH, ammonium concentrations). Indirect effects of fire include ash and debris flows, increases in water temperature, increased nutrient inputs, and sedimentation (Bozek and Young 1994; Gresswell 1999). Of these, ash flows probably have the greatest effect on spikedace and loach minnow. Ash and debris flows may occur months after fires when barren soils are eroded during the rainy season (Bozek and Young 1994; Brown et al. 2001). Ash and fine particulate matter created by fire can fill the interstitial spaces between gravel particles eliminating spawning habitat or, depending on the timing, suffocating eggs that are in the gravel. Ash and debris flows can also decimate aquatic invertebrate populations that the fish depend on for food (Molles 1985; Rinne 1996; Lytle 2000). The action area has experienced ash flows from several recent fires.

Stream and riparian condition

The West Fork Gila River is designated a High Quality Coldwater Aquatic Life stream by the State of New Mexico (New Mexico Environmental Department [NMED] 2010). Based on the latest water quality report for 2007 the River has exceeded its temperature criteria. Stream temperature exceedances may be a result of a decrease in riparian canopy or the River may be misclassified due to hot springs input (NMED 2010).

Riparian vegetation in the action area varies from low-stature willow stands and herb-dominated communities to riparian forest of mature cottonwood (*Populus fremontii*) and Arizona sycamore (*Platanus wrightii*) (Pittenger 2002). Exotic plants have not been found in the action area (Forest Service 2002).

Mature stands of trees tend to resist all but the most extreme flooding conditions and thereby reduce erosion, contain channel banks, and retard nutrient loss. However, the riparian community in the action area is in an early to mid-successional stage due to flooding events. Many portions of the riparian area do not have sufficient ground cover to protect stream banks from high flow events. The active channel is degraded and has limited the stream's ability to access a large portion of the floodplain during smaller flood events, leading to a loss of water storage in the sandy alluvium, lowering the water table, and limiting the potential for riparian regeneration within a significant portion of the floodplain. Due to channel incision, storms often show an increase in peak flows due to concentrations of flow in narrow, more efficient channels that convey runoff at much higher rates than the original channels. Decreased hydraulic roughness due to the general demise of woody riparian and herbaceous species in the action area has also increased water velocity. In its current state, the channel is continuing to incise, draining the floodplain, and resulting in loss of water storage (Forest Service 2002).

Watershed condition

The Gila National Forest Land Management Plan estimated the West Fork Gila River watershed in which the action area is located to have an optimum watershed condition (Forest Service 2002). This was determined by comparing the existing soil capability and hydrologic function to the potential conditions. However, upland watershed conditions show an overabundance of woody vegetation (areas with heavy canopy cover greater than 40 percent) at the expense of herbaceous understory, resulting in a significant decrease in ground cover. Damaging flood events occur more frequently from smaller precipitation events, due to the lack of ground cover failing to slow runoff and store water in the basin. There is also a reduction in mean annual flow from the watershed because of the transpiration needs of the increased upland woody vegetation. In short, the watershed has become flashier, but with decreased mean annual flow (Forest Service 2002).

Climate change

Warming of the earth's climate is unequivocal, as is now evident from observations of increases in average global air and ocean temperatures, widespread melting of glaciers and the polar ice cap, and rising sea level (Intergovernmental Panel on Climate Change [IPCC] 2007). The IPCC (2007) describes changes in natural ecosystems with potential widespread effects on many organisms, including freshwater fish. The potential for rapid climate change poses a significant challenge for fish and wildlife conservation. Species abundance and distribution is dynamic, and dependent on a variety of factors, including climate (Parmesan and Galbraith 2004). Typically, as climate changes, the abundance and distribution of fish and wildlife will also change. Highly specialized or endemic species are likely to be most susceptible to the stresses of changing climate. Based on these findings and other similar studies, the Department of the Interior requires agencies under its direction to consider potential climate change effects as part of their long-range planning activities.

In the Colorado River Basin, which includes the Gila River watershed, widespread, reliable temperature records are available for about the past 150 years. These records document an annual mean air surface temperature increase of approximately 1.4 °C (2.5 °F) over the past century with temperatures today at least 0.8 °C (1.5 °F) warmer than during the 1950 drought (Lenart et al. 2007; National Research Council [NRC] 2007). Udall (2007) found that multiple independent datasets confirm widespread warming in the West. Both in terms of absolute degrees and in terms of annual standard deviation, the Colorado River Basin has warmed more than any region of the U.S. (NRC 2007). Predicting with certainty the amount of warming that may occur in the future is not possible; however, the IPCC (2007) predicts that continued warming of the climate. Over western North America, median temperatures are projected to increase between 1.3 °C (2.3 °F) and 4.4 °C (7.9 °F) by year 2100 depending on the rate of greenhouse gas emissions (Christensen and Lettenmaier 2006).

The IPCC (2007) also projects that there will very likely be an increase in the frequency of hot extremes, heat waves, and heavy precipitation events. Climate forecasts project a northward shift in the jet stream and associated winter-spring storm tracks, which are consistent with observed trends over recent decades (Trenberth et al. 2007). This would likely result in future drier conditions for the Southwest and an ever increasing probability of drought for the region (Trenberth et al. 2007).

In consultation with leading scientists from the Southwest, the New Mexico Office of the State Engineer prepared a report for the Governor (New Mexico Office of State Engineer 2006) which made the following observations about the impact of climate change in New Mexico:

1. warming trends in the Southwest exceed global averages by about 50 percent;
2. modeling suggests that even moderate increases in precipitation would not offset the negative impacts to the water supply caused by increased temperature;
3. temperature increases in the Southwest are predicted to continue to be greater than the global average;
4. there will be a delay in the arrival of snow and acceleration of spring snow melt, leading to a rapid and earlier seasonal runoff; and
5. the intensity, frequency, and duration of drought may increase.

Consistent with the outlook presented for New Mexico, Hoerling and Eischeid (2007) states that, relative to 1990 through 2005, simulations indicate that a 25 percent decline in streamflow will occur from 2006 through 2030 and a 45 percent decline will occur from 2035 through 2060 in the Southwest. Seager et al. (2007) show that there is a broad consensus among climate models that the Southwest will get drier in the 21st century and that the transition to a more arid climate is already under way. Only 1 of 19 models has a trend toward a wetter climate in the Southwest (Seager et al. 2007).

Enquist et al. (2008) found that 93 percent of New Mexico's watersheds have became relatively drier from 1970 to 2006 and that snowpack in New Mexico's major mountain ranges has declined over the past 2 decades in 98 percent of the sites analyzed. The timing of peak streamflow from snowmelt in New Mexico is an average of 1 week earlier than in the mid-20th century (Enquist et al. 2008). Watersheds with the greatest declines in snowpack are those that have experienced the greatest drying from 1970 to 2006.

Increased winter temperatures can cause more precipitation to fall as rain instead of snow (Regonda et al. 2005). Snow can offer cover to small streams and provide valuable insulation that protects aquatic life (Needham and Jones 1959; Gard 1963). Gard (1963) measured temperatures above, within, and below the snow at Sagehen Creek, California, a small Sierra Nevada mountain stream. He found that although there was a 35.4 °C (63.8 °F) diurnal air temperature variation, within the snow the temperature variation was only 1.3 °C (2.3 °F) and the water temperature in the stream below varied by only 0.3 °C (0.6 °F). Without the protective cover of snow, anchor ice (ice frozen on the stream bed) and frazil ice (ice crystal suspended in the water) can form, having negative impacts on overwintering fish (Hurst 2007).

Climate change predicts four major effects on the spikedace and loach minnow habitat:

1. increased water temperature;
2. decreased streamflow;
3. a change in the hydrograph; and
4. an increased occurrence of extreme events (fire, drought, and floods).

Increased water temperature

Kundzewicz et al. (2007) state that of all ecosystems, freshwater ecosystems will have the highest proportion of species threatened with extinction due to climate change. Species with narrow temperature tolerances will likely experience the greatest effects from climate change and it is anticipated that populations located at the margins of species hydrologic and geographic distributions will be affected first (Meisner 1990). Small changes in water temperature are well known to have considerable effects on freshwater fishes by affecting a variety of life history, behavioral, and physiological aspects (Morgan et al. 2001; Carveth et al. 2006). Alterations in the temperature regime from natural background conditions negatively affect population viability, when considered at the scale of the watershed or individual stream (McCullough 1999). Small streams in the Gila River basin experience high summer temperature. Spikedace and loach minnow have thermal tolerances in the lower range for native fishes (Carveth et al. 2006; Widmer et al. 2006). As such, these species may be adversely affected by increased water temperature.

Decreased streamflow

Current models suggest a decrease in precipitation in the Southwest (Kundzewicz et al. 2007; Seager et al. 2007) that would lead to reduced streamflows and a reduced amount of habitat for spikedace and loach minnow. Stream flow is predicted to decrease in the Southwest even if precipitation were to increase moderately (Nash and Gleick 1993; New Mexico Office of State Engineer 2005; Hoerling and Eischeid 2007). Winter and spring warming causes an increased fraction of precipitation to fall as rain, resulting in a reduced snow pack, an earlier snowmelt, and decreased summer base flow (Christensen et al. 2004; Regonda et al. 2005; Stewart et al. 2005). Earlier snowmelt and warmer air temperatures can lead to a longer dry season. Warmer air temperatures lead to increased evaporation, increased evapotranspiration, and decreased soil moisture. These three factors could lead to decreased streamflow even if precipitation increased moderately.

The effect of decreased streamflow is that streams become smaller, intermittent, or dry and thereby reduce the amount of habitat available for aquatic species. As streams become smaller, intermittent, or dry the potential of increase in nonnative competition is possible. A smaller stream is affected more by air temperature than a larger one, exacerbating the effects of warm and cold air temperatures (Smith and Lavis 1975). In addition, fish isolated in pools may be subject to increased predation from terrestrial predators.

Change in the hydrograph

Another documented effect of climate change is that warming in the Southwest has resulted in a shift of the timing of spring snowmelt. Stewart et al. (2005) show that timing of spring streamflow in the Southwest during the last 5 decades has shifted so that the major peak now arrives 1 to 4 weeks earlier, resulting in less flow in the spring and summer. They conclude that almost everywhere in North America, a 10 to 50 percent decrease in spring-summer streamflow fractions will accentuate the seasonal summer dry period with important consequences for warm-season water supplies, ecosystems, and wildfire risks (Stewart et al. 2005). Rauscher et al. (2008) suggest that with air temperature increases of 3 to 5 °C (37 to 41 °F), snowmelt driven runoff in the Southwest could occur as much as 2 months earlier than present. Changes in the hydrograph could potentially alter the native fish assemblages. Variability in the hydrographs and greater flow volume has been shown to sustain native fishes (i.e., spikedace and loach minnow) over nonnatives between periodic flood events (Rinne and Miller 2006).

Increased occurrence in extreme events

Extreme events such as drought, fires, and floods are predicted to occur because of climate change (IPCC 2007). It is anticipated that an increase in extreme events will most likely affect populations living at the edge of their physiological tolerances. The predicted increases in extreme temperature and precipitation events may lead to dramatic changes in the distribution of species or to their extirpation or extinction (Parmesan and Matthews 2006).

<u>Drought</u>

The Southwest U.S. is currently experiencing drought conditions (University of Nebraska-Lincoln 2010). Portions of New Mexico are also considered abnormally dry, but not in areas currently occupied by spikedace and loach minnow (University of Nebraska-Lincoln 2010). While spikedace and loach minnow have survived many droughts in their evolutionary histories, the present status of these species and their habitat are so degraded that the effects of the drought may be more difficult for the species to withstand. In some areas of spikedace and loach minnow habitat, drought results in lower streamflow and consequent warmer water temperatures, and more crowded habitats with potentially higher levels of predation and competition. In other areas drought reduces flooding, which would normally rejuvenate habitat and tend to reduce populations of some nonnative species, which are less adapted to the large floods of Southwest streams (Minckley and Meffe 1987; Stefferud and Rinne 1996).

The land designation above the Project area is wilderness, with few human impacts. Therefore, it is possible that the lack of regular flooding and the past drought (reduced flows in the summer, warmer than normal water temperatures) are responsible for the current decline in the species in the area. It is also possible that the fish are responding to factors that we have not identified that may be having a negative effect on the population. At this time, we do not know if the observed declines in population densities for spikedace and loach minnow are part of normal, long-term population fluctuations.

Although spikedace and loach minnow evolved in the Southwest and have survived drought in the past, it is anticipated that a prolonged, intense drought would adversely affect many spikedace and loach minnow populations, in particular those occupying the upper Gila River drainage. During droughts within the upper reaches of the Gila River drainage an increase in nonnative predators was observed (Propst et al. 2008). In addition to stream drying, there is a clear association between severe droughts and large fires in the Southwest (Swetnam and Baisan 1996).

Fire

Since the mid-1980s, wildfire frequency in western forests has nearly quadrupled compared to the average of the period 1970 through 1986. The total area burned is more than six and a half times the previous period (Westerling et al. 2006). In addition, the average length of the fire season during 1987 to 2003 was 78 days longer compared to 1970 through 1986, and the average time between fire discovery and control increased from 7.5 to 37.1 days for the same time frames (Westerling et al. 2006). McKenzie et al. (2004) suggest, based on models, that the length of the fire season will likely increase further and that fires in the western U.S. will be more frequent and more severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming (McKenzie et al. 2004).

Floods

Floods that occur after intense wildfires that have denuded the watershed are also a threat. An increase in rain or snow events, intense precipitation that is unseasonable or heavy precipitation that occurs after fire, could impact spikedace and loach minnow. High-severity wild fires, subsequent floods, and ash flows have caused the extirpation of some fish populations (Propst et al. 1992; Brown et al. 2001), but it is not known if spikedace or loach minnow have suffered local extirpations.

The conjunction of climate change with ongoing habitat loss and alteration; and nonnative species competition has caused a general loss of resiliency in the ecosystem that has serious consequences for spikedace and loach minnow.

EFFECTS OF THE ACTION

Direct Effects

Potential adverse effects of the action include streambed disturbance by heavy equipment (rubber-tired backhoe and front-end loader); a temporary increase in turbidity; increased sedimentation downstream; and diversion of the channel adjacent to NM 15 Bridge. The action will take place outside the spawning season for spikedace and loach minnow and during low flow (September-October), so eggs are unlikely to be affected by construction. Implementation of proposed conservation measures and compliance with section 401 and 404 permits will reduce potential adverse impacts.

Fish surveys conducted in recent years within and near the action area have documented spikedace in the area, but none have found loach minnow (Paroz and Propst 2007; Pittenger 2010). Loach minnow are known to occur in the West Fork Gila River; however, very few loach minnow have been collected recently (Paroz and Propst 2007). Loach minnow are benthic dwellers, and may not be readily detected when low in abundance. This species is probably very rare or in low numbers in the action area.

In the unlikely event that loach minnow are present in the action area, they could be killed or injured due to construction activities in the river channel, as well as during preconstruction fish sampling. It is possible that the heavy equipment could crush spikedace or loach minnow, although the likelihood of this occurring is very low. This equipment would be in the river channel fewer than 40 hours, and we expect that healthy fish would detect the approach of a large, slow-moving object, such as a backhoe or front-end loader, and flee the area. However, the possibility that a fish could be caught and crushed under the treads cannot be ruled out. Because recent surveys just upstream from the action area have found very few spikedace and loach minnow the probability that any fish would be directly impacted by the heavy equipment is reduced. Prior to construction the action area will be surveyed, and fish and other aquatic vertebrates will be salvaged. The absence of spikedace or loach minnow in the Project area based on these efforts will be an indicator of low risk of impacts to the species. In addition, block nets used during survey will remain in place during project implementation to prevent fish from reentering the Project area.

Indirect Effects

The heavy equipment will likely crush and kill many invertebrates, a primary food source for the spikedace and loach minnow. Some invertebrates will be dislodged from the substrate and drift downstream. However, the area directly disturbed by the heavy equipment is very small (70 m^2 [759 ft^2]), relative to the upstream river area that would serve as a source of invertebrate colonizers. Flow will be diverted around the Project area using concrete wall barriers that could be habitat for invertebrates. Some water will remain in the channel, leaving a limited amount of habitat for those invertebrates capable of moving back to the main flow of the channel. However, many invertebrates may die, if they were incapable of finding water, or if exposed to predation as they drifted downstream.

The action area will have a limited food source for fish until the habitat is recolonized by invertebrates. Colonization should occur primarily from drift from upstream (Williams and Hynes 1976). Some colonists will occupy the habitat almost immediately but the density of invertebrates will be very low. Because both spikedace and loach minnow depend on aquatic invertebrates as a major food source, the disturbed channel will have a short term impact approximately 6-12 months on the food supply until the channel is fully recolonized. The project actions will temporarily increased food supply to downstream invertebrate-eating species, including spikedace and loach minnow.

Suitable physical habitat will be created for loach minnow in the disturbed channel but insufficient food would be available to the species for several months. Consequently there is a net loss of suitable habitat in the short term because of the Project.

Turbidity in the action area and downstream will increase when the heavy equipment are working on the Project. There are two consequences from this activity, one positive and one negative. The potential negative impact is caused by the increase turbidity and deposition of fines (silt and sand) downstream of the action area. This effect will be of moderate intensity and short duration. Spikedace and loach minnow were documented downstream of the action area at Heart Bar in 1996 (Propst et al. 1998). Because surveys have not been conducted at this location since that time it is not known if a population is still present. The downstream turbidity is not expected to cause mortality to either fish or invertebrates. It would likely cause a slight incremental increase in embeddedness at downstream locations. Although some turbidity is normal during the winter, the effect of this one-time event will increase turbidity for a limited time. However, we anticipate the impacts of this increase will be minor.

In contrast limited inputs of sediment could benefit the habitat in the action area. The substrate in the action area is embedded because the cobble and gravel are firmly cemented by fine material. Loach minnow need gaps beneath and around cobbles for cover and egg deposition. The action of the heavy equipment on the substrate would be to break up the embeddedness and clean the substrate of fine sediment. Substrate suitability for loach minnow would likely improve in the action area by the heavy equipment activity. Habitat suitability for spikedace would most likely decrease because habitat variability will decrease. The action area is a straight and relatively uniform riffle, habitat that favors loach minnow. The channel adjacent to NM 15 Bridge has a variety of habitats including pools, riffles, and runs that favor spikedace.

Designated Critical Habitat

Effects of the designated critical habitat PCEs is the same as described in the previous paragraphs. This Project will temporarily modify approximately 0.28 ha (0.68 acres) of designated critical habitat. The total linear length of designated critical habitat impacted will be approximately 82 m (270 ft). This area will most likely maintain the PCEs in the future. Temporary effects to PCEs that may occur in the downstream of the action area include changes to the flow, amount of fine sediment and substrate embeddedness, contaminants, and the aquatic food base. These downstream changes are expected to be temporary during project implementation, and are expected to return preconstruction conditions.

These effects will not measurably reduce the ability of the designated critical habitat to contribute to the recovery for both spikedace and loach minnow at either the Upper Gila Complex or rangewide.

PCE 1 pertains to the presence of permanent, flowing, water with no or minimal pollutant levels. The Project will alter flow patterns for a short term and measures are proposed to minimize any potential pollutants. PCE 2 pertains to maintenance of appropriate substrates and particle size distributions, and maintenance of a hydrograph that allows for adequate river functions. The Project area has high embeddedness. The action will improve substrate condition through reducing embeddedness. The action will not alter the flood or base flow hydrographs of the Gila River. PCE 3 pertains to streams gradient; water temperature; pool, riffle, run, and backwater components; and an abundant aquatic insect food base. Because of the small scale of the impacts there will be no change to stream gradient or habitat components. The aquatic food base will be temporarily disturbed, but is expected to return to normal levels. PCE 4 includes maintaining habitat devoid of nonnative fish species detrimental to loach minnow or habitat in which detrimental nonnative fish species are at levels which allow persistence of both spikedace and loach minnow. The action will have no effect on nonnative fish abundance or distribution. PCE 5 addresses the need to maintain connective corridors between occupied or seasonally occupied habitat and through which the species may move when the habitat is wetted. The action includes a short-term (5-day maximum) diversion of the Gila River, but this effect will be temporary. The action's limited effects to the PCEs are unlikely to appreciably diminish or preclude the role of the action area in both the survival and recovery of the species.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local, or private actions on endangered or threatened species or designated critical habitat that are reasonably certain to occur in the foreseeable future in the action area considered in this biological opinion. Future Federal actions that are unrelated to the action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Cumulative effects analysis as stated here applies to section 7 of the Act and should not be confused with the broader use of this term in the National Environmental Policy Act or other environmental laws.

Two actions may cumulatively affect spikedace and loach minnow in this location. First, the road will need ongoing maintenance and bank stabilization by the State, because the road is in the floodplain and the bridge span is too short to allow the river to move naturally. Road maintenance at this location is ongoing, and will require continued measures to keep the road open.

Wildfires are another source of cumulative effects. Although these fires occur on Forest Service lands, they are started by lightning strikes, and are not planned. Consequently, the Forest Service does not consult on these fires except after-the-fact, as an emergency consultation. Therefore, the effects of these fires are not analyzed until after the action and impacts occur (i.e., ash flows). The effects of wildfires on spikedace and loach minnow are described above in the "Status of the Species" section.

CONCLUSION

After reviewing the current status of spikedace and loach minnow, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is the Service's biological opinion that the action, is neither likely to jeopardize the continued existence of the two species, nor likely to destroy or adversely modify their designated critical habitat. We reached this conclusion because the action is very limited in scope, conservation measures will be in place, the action will occur outside the spawning period, and if the species are present in the action area they will be translocated upstream prior to construction. The substrate is so embedded in the channel running adjacent to the Project area, that the construction activity may improve habitat quality for loach minnow. Specifically, it may create cleaner, less embedded substrate, which these species require for successful reproduction, resulting in improved habitat conditions within the footprint of the action. However, habitat quality immediately downstream of the Project may become impaired in the short term because of the fine sediments released from the Project area and carried downstream.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting, or attempting to engage in any such conduct. Harass is further defined by us as intentional or negligent actions that creates 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, and sheltering. Harm is further defined by us to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as 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 a prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Amount and Extent of Take Anticipated

The Service has developed the following incidental take statement based on the premise that NMDOT's abutment repairs at the New Mexico Highway 15 (NM 15) Bridge on the West Fork Gila River will be implemented as proposed. Take of spikedace and loach minnow is expected in the forms of harm and harassment due the proposed bridge repair activities, and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, the Corps must reinitiate consultation.

Based on the best available information concerning spikedace and loach minnow, the habitat needs of these species, the project description, and information furnished by NMDOT, take is considered likely for both spikedace and loach minnow during the proposed action. Nevertheless, because of the low density of this species in the action area, the lack of recent data on the species presence, the difficulty of detecting harassment of a small fish, and the expectation that no other form of take will occur (e.g., no mortalities or injuries that might be more detectable), it is not possible to estimate the number of individuals that will be taken with implementation of this project. Based upon the proposed project, it is estimated that harm of both spikedace and loach minnow will occur in occupied habitat over a footprint of approximately 70 m^2 (759 ft^2) of disturbed habitat, temporary modification of 0.28 ha (0.68 acres) of designated critical habitat. Although we expect a low likelihood of both spikedace and loach minnow presence due to low densities in the action area, we anticipate that some individual spikedace or loach minnow or both will be taken in the form of harassment within this footprint.

The Service notes that this represents a best estimate of the extent of take that is likely during the proposed action. Thus, estimated incidental take may be modified from the above should population monitoring information or other research indicate substantial deviations from the estimated extent of incidental take, or if it allows for a calculation of the amount of take that will occur. In this case further consultation may be necessary.

Effect of the take

In this biological opinion, the Service determines that the level of take did not result in jeopardy to spikedace or loach minnow, nor destruction or adverse modification of designated critical habitat. The Service reached this conclusion because:

1. the amount of area disturbed is very limited;
2. the amount of time that the area will be disturbed is very limited (direct impacts up to 5 days or less within the River);
3. the likelihood that spikedace and loach minnow occupied the action area at the time of the action is low because abundance is low in the area, and any fish present will be translocated prior to implementation of the action;
4. contamination of the river by petroleum products will be minimized as described in their conservation measures;
5. conditions of the 401 and 404 permits will be followed; and
6. primary constituent elements of designated critical habitat will be insignificantly affected.

Reasonable and Prudent Measures

No reasonable and prudent measures or terms and conditions are identified, as the conservation measures include all reasonable and prudent measures necessary to minimize incidental take.

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 an action on listed species or designated critical habitat, to help implement recovery plans, or to develop information. The recommendations provided here relate only to the action and do not necessarily represent complete fulfillment of the agency's section 7(a)(1) responsibility for these species. In order for us to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species and their habitats; we request notification of the implementation of the conservation recommendations. We recommend the following conservation recommendations be implemented.

1. Because of the location and dimensions of the NM 15 road and bridge maintenance issues are ongoing and erosion will likely occur. A long-term solution that addresses the continual maintenance on the NM 15 road bed and bridge should be pursued.

2. NMDOT should investigate the functionality of a low water crossing at this location.

3. Based on previous discussions on the feasibility of rebuilding the NM 15 bridge NMDOT should complete an engineering study to identify appropriate bridge alternatives.

Reporting Requirements/Disposition of Dead or Injured Listed Animals

Upon finding a dead or injured threatened or endangered animal, initial notification must be made to the Service's Division of Law Enforcement, 4901 Paseo Del Norte NE, Suite D, Albuquerque, New Mexico, 87113 (505-346-7828) within 3 working days of its finding. Written notification must be made within 5 calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. Care must be taken in handling injured animals to ensure effective treatment and care and in handling dead specimens to preserve biological material in the best possible condition. If feasible, the remains of intact specimens of listed animal species shall be submitted as soon as possible to the nearest Service or NMDGF office, educational, or research institutions (e.g., University of New Mexico) holding appropriate state and Federal permits.

CLOSING STATEMENT

This concludes formal consultation on the NM 15 Bridge abutment repair permit. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may adversely affect listed species or designated critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to a listed species or designated 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 this action.

We appreciate the U.S. Army Corps of Engineers' and New Mexico Department of Transportation efforts to identify and minimize effects to listed species from this Project. In future communications regarding this Project please refer to consultation number 22420-2010-F-0090. If you have any questions or would like to discuss any part of this biological opinion, please contact Melissa Mata of my staff at (505) 761-4743 or Melissa_mata@fws.gov.

Sincerely,

Wally Murphy
Field Supervisor

cc:
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