United States Department of the Interior
U.S. Fish and Wildlife Service
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AESO/SE
2-21-89-F-071, 2-21-94-I-386,
2-21-95-I-440, 2-22-99-F-016,
2-21-01-F-011, 000089RO December 30, 2002

Mr. Michael R. King
Forest Supervisor
Prescott National Forest
344 South Cortez
Prescott, Arizona 86303

Dear Mr. King:

This biological opinion responds to your request for consultation with the U.S. Fish and Wildlife Service's (Service) pursuant to section 7 of the Endangered species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request for formal consultation was dated April 30, 2001, and was received by us on May 1, 2001. Consultation with the Service was formally initiated on November 23, 2001. At issue are impacts that may result from the proposed and ongoing livestock grazing activities on 16 allotments of the Verde River watershed, on the Chino Valley and Verde Ranger Districts, Prescott National Forest (PNF), and Williams Ranger District, Kaibab National Forest, in Coconino and Yavapai counties, Arizona.

This biological opinion is based on information provided in the April 30, 2001, Biological Evaluation (BE) (USFS 2001a), the "Watershed Condition Assessment for Select Verde River 5th Code Watersheds (USFS 2001b), the Forest Service correspondence dated November 20 and December 12, 2001, telephone conversations and/or electronic mail transmissions with Mike Leonard, Team Leader for Wildlife, Fish and Rare Plants, and other sources of information. A complete administrative record of this consultation is on file at this office.

Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, livestock grazing and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at this office.

Table of Contents

CONSULTATION HISTORY

All of the grazing allotments discussed herein have undergone previous formal or informal section 7 consultation in previous years. Whereas some of the consultations were completed by this field office, others were conducted by the New Mexico field office and the Regional Grazing Team, making tracking the history of these consultations difficult.

Based on the limited information available to date, the following table serves to summarize the consultation history for the allotments considered herein:

Allotment Name	Consultation Reference Number(s)	USFS Effects Determination (Most Recent)
Antelope Hills	**2-21-94-I-386, 000089RO, 2-22-99-F-016, 2-21-01-F-011**	**Loach Minnow: NE[1] (1998) Spikedace: MANLA[2] (1998) Critical Habitat: MANLA[3] (2001)**
Brown Springs	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
China Dam	**2-21-95-I-440, 000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Copper Canyon	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Horseshoe	**2-21-94-I-386, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Jerome	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**

[1] No Effect

[2] May Affect, Not Likely to Adversely Affect

[3] Effects determination of may effect, not likely to adversely affect for critical habitat applies to both spikedace and loach minnow within the 4th Code Verde watershed.

Limestone[4]	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (2001) Spikedace: MANLA (2001) Critical Habitat: MANLA (2001)**
Muldoon	**2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Perkinsville	**2-21-94-I-386, 000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Sand Flat	**2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Squaw Peak	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Sycamore	**2-22-99-F-016**	**Loach Minnow: NE (2001) Spikedace: MANLA (2001) Critical Habitat: MANLA (2001)**
Tule	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Verde	**2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
West Bear / Del Rio	**2-22-89-F-071, 000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**
Young	**000089RO, 2-22-99-F-016**	**Loach Minnow: NE (1998) Spikedace: MANLA (1998) Critical Habitat: MANLA (2001)**

In April 2000, critical habitat for both the spikedace and loach minnow was designated along 106 miles of the Verde River mainstem and its 100-year floodplain, from the confluence with Fossil Creek upstream to Sullivan Dam [Federal Register Vol. 63 (80):24328-24372] (USFWS 2000). Consequently, this recent designation of critical habitat constitutes new information under the re-initiation criteria pursuant to 50 CFR §402.16. The Service will therefore consider the effects of the proposed action on the spikedace, loach minnow, as well as the designated critical habitat for each species.

[4] Effects determinations for Limestone and Sycamore allotments made during personal verbal communications with Mike Leonard, Prescott National Forest, USFS on December 17, 2001.

This consultation was formally initiated on November 23, 2001. Pursuant to 50 CFR §402.14, the formal consultation period expires within ninety calendar days of initiation and allows for an additional forty-five calendar days from termination of consultation for the Service to issue a biological opinion. The formal consultation period, as defined in 50 CFR §402.02, ended April 8, 2002.

The USFS provided, via facsimile transmission on February 10, 2002, a list of applicants associated with the Federal action for which this opinion considers. These applicants are:

1) David Gipe
PO Box 286
Paulden, Arizona 86334

2) Donald Verner
PO Box 335
Paulden, Arizona 86334

3) Andy Groseta
Groseta Ranches
PO Box 1619
Cottonwood, Arizona 86326

4) George and Sharon Yard
5455 Hidden Hallow Road
Flagstaff, Arizona 86991

5) William Fix
9005 Old Munds Hwy
Flagstaff, Arizona 86991

6) Silkie Perkins
PO Box 365
Clarkdale, Arizona 86324

A draft biological opinion was sent to the USFS on April 17, 2002, which requested a sixty (60) day extension. On May 28, 2002, USFS and Service personnel attended a meeting in Camp Verde, Arizona to discuss unrelated legal proceedings involving the potential remand of critical habitat considered in this biological opinion. During the meeting, discussions were held which pertained to how this scenario could affect the outcome of this consultation and explored each agency's roles should it occur. In a letter dated August 6, 2002, the USFS responded to the draft biological opinion with comments for consideration. The comments, however, were officially withdrawn by the USFS in a letter dated December 17, 2002.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action involves the implementation of a livestock grazing program on 16 ongoing and/or proposed livestock grazing allotments along five 5th code sub-watersheds within the larger 4th code Verde River watershed of the Chino Valley and Verde Ranger Districts, Prescott National Forest, and Williams Ranger District, Kaibab National Forest, in Coconino and Yavapai counties, Arizona (see map provided). Each allotment, whether ongoing or proposed, operates under a ten-year Term Grazing Permit. Specifically, the 5th code sub-watersheds where the allotments under consultation reside include Granite Creek, Hell Canyon, Sycamore Creek, Verde, and Gap Creek.

The action area for a project is defined by the total area affected, either directly or indirectly, by the implementation of the Federal action under consultation. For the proposed projects, the action area includes the area contained within all the allotments (Antelope Hills, Brown Springs, China Dam, Copper Canyon, Horseshoe, Jerome, Limestone, Muldoon, Perkinsville, Sand Flat, Squaw Peak, Sycamore, Verde, West Bear/Del Rio, and Young allotments on the Prescott National Forest, and the Tule allotment on the Kaibab National Forest). Included within this action area is the 100-year floodplain and active channel of the Verde River in addition to all perennial, intermittent or ephemeral tributaries of the Verde River within the area described herein, and the upland areas (within the aforementioned allotments) that drain into these tributaries or into the Verde River. With streams, the action area is often much larger than the footprint of the proposed project because impacts may be carried downstream with the flow. Watersheds and sub-watersheds are comprised of numerous inter-connected upland and riparian areas that function together as an ecological unit. As a result, activities in one part of the watershed can affect adjacent areas and activities in the uplands can affect riparian areas. Therefore, the Service is including the Verde River (active channel and associated 100 year floodplain) downstream of the southern boundary of the PNF to the confluence with Fossil Creek as within the action area for these projects. The confluence with Fossil Creek is the termination of designated critical habitat on the Verde River for spikedace and loach minnow. This approximate 25-mile distance, from the southern PNF boundary to the confluence with Fossil Creek, is also consistent with Forest Service guidelines for determining the reasonable extent for occurrence of downstream effects.

Each allotment considered under this consultation is organized based upon its proximity to, or location on the Verde River (upper reach, middle reach, lower reach) and is specifically described below:

Verde River: Upper Reach

Limestone

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Hells Canyon (~33,228 acres), Granite Creek (~2,815 acres)
Consultation Period:	Remaining time on a ten year permit issued in 1998; current permit expires on 12/31/08
Allotment Acres (capacities):	57,627 Total / 45,250 Full / 3,606 Potential / 8,771 No Capacity
Stocking Density (AUMs):	928 (previous permitted) / 811-928 (previous actual) / 928 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Rest-deferred or Deferred Rotation (dependent upon stockwater)

Elevation (feet): 4,500 - 6,000

Discussion: In 1988, permitted stocking rates were reduced by 91% from 9,710 AUMs to 918 AUMs after a continued downward trend in range condition, a rating of poor to very poor on nearly all acres, unacceptable soil loss on some acres, and a desire by the Prescott NF to realize the moderate revegetation potential on one-half of the allotment. As proposed, the Limestone allotment is currently supporting up to 928 AUMs (102 head of cattle) during the time frame spanning from 1998 through 2008 on 3 pastures used at various times from June through February annually. Grazing activity is managed as either a deferred rotational system or a rest-rotation, dependent upon stockwater, using a 30-40% species-dependent vegetative utilization rate.

While portions of two 5th code watersheds (Hell Canyon and Granite Creek) exist within the 57,627 acre Limestone allotment, no perennial stream reaches lie within the boundaries of the Limestone and consequently, no designated critical habitat exists within the allotment.

Conservation Measures/Management Objectives

The PNF has proposed two management objectives for the Limestone allotment. These include lessening impacts from grazing on areas livestock prefer by salting in areas of forage that are used infrequently and following moderate utilization guidelines.

West Bear/Del Rio

Forest: Prescott

Ranger District: Chino

5th Code Watershed: Verde (~659 acres), Hell Canyon (~57,910 acres), Granite Creek (~13,746 acres)

Consultation Period: 2002 through 2010; current permit expires on 12/31/10

Allotment Acres (capacities): 72,315 Total / 57,441 Full / 4,979 Potential / 9,895 No Capacity

Stocking Density (AUMs): 7,800-10,200 (current permitted) / 5,392 (current actual, 4 year average) / 7,800 - 10,200 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Deferred Rotation

Elevation (feet): 4,000 - 5,800

Discussion: The West Bear/Del Rio allotment is currently supporting up to 10,200 AUMs (850 head of cattle and 10 horses) and will continue to do so through 2010 on 21 pastures which are not designated strictly for either winter (dormant season) or summer (growing season) use. The Allotment Management Plan (AMP) calls for 37 pastures with 15 pastures designated for dormant season use and 25 pastures designated for growing season use. Grazing activity is managed under a deferred rotational system using a recovery/rest strategy in which livestock management is based upon the monitored assessment of ground cover and recovering leaf area. During the dormant season, the herd is split into two smaller herds. Of the total 37 pastures required under the AMP, 15 pastures will be utilized by two smaller herds during the dormant season with 25 pastures utilized by a single, combined herd during the growing season.

The 311 riparian acres within the allotment are adjacent to 9.7 miles of the Verde River (critical habitat potentially occupied by spikedace) and are excluded from livestock use. This 9.7 mile reach has been classified as "functional at risk, with an upward trend using the Proper Functioning Condition stream assessment protocol.

Livestock will have access to potentially occupied (spikedace) critical habitat on the Verde River during river crossings. The crossing are expected to occur at the convenience of a private landowner in the area at undetermined intervals and frequency. This particular river crossing is not proposed for monitoring of aquatic habitat but the USFS Rocky Mountain Research Station actively monitors water quality above and below the private land.

Conservation Measures/Management Objectives

The PNF has proposed several management objectives for the West Bear/Del Rio allotment. These include 1) providing habitat for riparian and aquatic wildlife and native fish species by maintaining Proper Functioning Condition of riparian-wetland areas of the Verde River; 2) retaining or increasing vegetative ground cover to improve the soil and watershed condition of the uplands and, on the Hills and Plains ecological land unit, to increase vegetative ground cover by 5% in areas currently below potential; 3) maintaining pronghorn habitat on the Plains, including maintaining the extent and quality of existing grasslands and providing sufficient herbaceous vegetation for fawning cover from April through May; and, 4) providing forage and cover for small mammals.

Muldoon

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (~6,086 acres), Granite Creek (~17,810 acres), Hell's Canyon (~99 acres)
Consultation Period:	2002 through 2012; current permit expires on 12/31/09
Allotment Acres (capacities):	23,995 Total (NF) 25,067 Total (fenced) / 19,665 Full / 1,531 Potential / 2,809 No Capacity
Stocking Density (AUMs):	2,340 (current permitted) / 1,572-2,340 (current actual) / 1,572-2,340 (proposed)
Livestock Kind:	Cattle-mature
Proposed Grazing System:	Deferred rotation with variable numbers and season
Elevation (feet):	4,180 - 6,300

Discussion: The Muldoon allotment is currently supporting up to 2,340 AUMs (195 head of cattle) and this rate is proposed to continue through 2009 on 5 different pastures utilized at various times throughout the calendar year. Grazing activity is managed under a deferred rotational system with variable numbers and season, using a 40% vegetative utilization rate.

The 3.6 perennial miles, existing within the Muldoon allotment, of critical habitat potentially occupied by spikedace on the Verde River are excluded from livestock use and monitored for stray cattle.

Conservation Measures/Management Objectives

Two primary management objectives exist for this allotment. The objectives are to increase vegetative ground cover and frequency of perennial plants in areas where soil condition is noted as undesirable. To meet these objectives, several improvements are proposed for the Muldoon allotment which include the construction of 1) 2 wells; 2) 8 miles of pipelines; 3) 10 drinkers along pipelines; 4) 8 miles of fence to create pastures of equal size and vegetation characteristics; and 5) the reconstruction of 3 miles of fence to meet pronghorn standards.

China Dam

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (~10,325 acres); Granite Creek (~5,622 acres)
Consultation Period:	2002 through 2012; current permit expires on 12/31/05
Allotment Acres (capacities):	15,947 Total / 11,268 Full / 1,223 Potential / 3,456 No Capacity
Stocking Density (AUMs):	1260 (permitted) / 0-1260 (current)
Livestock Kind:	Cow-calf
Proposed Grazing System:	Deferred Rotation
Elevation (feet):	4,100 - 4,800

Discussion: After a 56% reduction in livestock numbers in 1976, the China Dam allotment is currently supporting up to 1,260 AUMs (180 head of cattle) and this rate is proposed to continue through 2005 on 3 pastures. Pastures are to be used from November 1 through May 31 annually as no summer grazing activity is currently allowed. Grazing activity is managed under a deferred rotational system using a 35% vegetative utilization rate during the growing season and a 50% utilization rate during the dormant season in key areas.

Three perennial miles of critical habitat, potentially occupied by spikedace, lie within the allotment on the Verde River. A total of 116 riparian acres are present on the allotment but are not accessible to grazing activity and are being monitored for stray cattle to ensure exclusion. The PNF has noted that poor distribution of cattle and limited water development contribute to the inability to manage cattle here.

Conservation Measures/Management Objectives

Two primary management objectives exist for this allotment. The objectives are to increase vegetative ground cover and the frequency of perennial plants in areas where soil condition is noted as undesirable. To meet these objectives, several improvements are proposed for the China Dam allotment such as the installation of two water wells, 5 miles of pipeline, 10 water drinkers, and 2.5 miles of fenceline, to keep cattle off the Verde River if found necessary.

Sand Flat

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (~20,815 acres), Hells Canyon (~2,268 acres), Sycamore (~28 acres)
Consultation Period:	2002 through 2012; current permit expires on 12/31/04
Allotment Acres (capacities):	23,111 Total / 13,111 Full / 7,184 Potential / 2,816 No Capacity
Stocking Density (AUMs):	1,500 (current permitted) / 630-1,500 (current actual) / 938-1,400 (proposed)
Livestock Kind:	Cattle-mature
Proposed Grazing System:	Deferred Rotation
Elevation (feet):	4,000 - 5,600

Discussion: The Sand Flat allotment is currently supporting up to 1,500 AUMs (320 head of cattle) and will continue to do so through 2004 on 3 winter/spring pastures. Grazing activity is managed under a deferred rotational system using a 40% vegetative utilization rate in key areas. Grazing periods for the Sand Flat occur from mid-December through April of the following year. There is no summer grazing permitted on this allotment.

The 47 riparian acres within the allotment are adjacent to 1.7 miles of critical habitat potentially occupied by spikedace on the Verde River and are excluded from livestock use. This 1.7 mile reach has been classified as "functional at risk, with an upward trend using the Proper Functioning Condition stream assessment protocol.

Conservation Measures/Management Objectives

Two primary management objectives exist for this allotment. These objectives are to increase vegetative ground cover and frequency of perennial plants in areas where soil condition is noted as undesirable. To meet these objectives, improvements in fencing and water development are proposed for the Sand Flat allotment. Specifically, these improvements consist of 1) the cleaning and repair

of 10 earthen water tanks; 2) the reconstruction of 3 earthen water tanks; 3) the installation of a well to improve reliability of water supplies; and 4) the construction of 3.5 miles of fencing for exclusion purposes.

Tule

Forest:	Kaibab
Ranger District:	Williams
5th Code Watershed(s):	Sycamore Canyon (acreage unknown)
Consultation Period:	2002 through 2012; current permit expires on 12/31/04
Allotment Acres (capacities):	60,309 Total / 54,307 Full / 0 Potential / 6,002 No Capacity
Stocking Density (AUMs):	2,250 (current permitted) / 2,250 (current actual) / 2,250-2,400 (proposed)
Livestock Kind:	Cow-calf
Proposed Grazing System:	Rest-rotation
Elevation (feet):	6,200 - 7,600

Discussion: The Tule allotment is the only allotment which is not part of the PNF, but instead the Kaibab National Forest, and currently supports 2,250 AUMs (320 head of cattle) and is proposed to continue through 2004 on 3 fall/spring and 6 summer pastures. No pasture will be grazed for longer that 45 to 60 days. Grazing activity is managed under a rest-rotational system using a 40% vegetative utilization rate in key areas.

According to the Kaibab National Forest and reported by the PNF, there are no perennial stream reaches within the Tule allotment and, hence, no designated critical habitat.

Conservation Measures/Management Objectives

Improvements proposed for the Tule include 300 acres of pinyon/juniper treatment, the reconstruction of two stock tanks, and the construction of approximately 0.5 miles of fencing.

Perkinsville

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (~33,415 acres), Sycamore Canyon (~18,277 acres)
Consultation Period:	2002 through 2012; current permit expires on 12/31/06
Allotment Acres (capacities):	51,692 Total / 35,723 Full / 1,849 Potential / 14,041 No Capacity
Stocking Density (AUMs):	3,192 (current permitted) / 2,443-3,192 (current actual) / 2136-3192 (proposed)
Livestock Kind:	Cow-calf
Proposed Grazing System:	Deferred Rotation
Elevation (feet):	3900 - 7000

Discussion: The Perkinsville allotment is currently supporting up to 3,192 AUMs (266 head of cattle) with 3 herds in 9 winter/spring pastures and will continue through 2006. Proposed management would support two herds on 4 winter pastures and one herd rotating through 9 summer pastures. Grazing activity is managed year-round under a deferred rotational system using a 40% vegetative utilization rate in key areas.

The 417 riparian acres within the allotment, adjacent to 1.6 miles of the Verde River which is critical habitat potentially occupied by spikedace, are partially excluded from livestock use as well as monitored for strays and vegetative utilization. Access by cattle to the Verde River is expected to occur during crossings immediately downstream of the bridge at Perkinsville. The PNF states that crossing are approximately 3 to 5 minutes in duration and consist of approximately 100 head of cattle during each crossing, although some crossings may be considerably less (10 to 20 head). Crossings generally occur twice in November and two to four times in May when livestock move into new pastures which is largely dependent on forage conditions. However, an additional four crossings are planned in the proposed grazing system.

Another form of river access is expected to occur at a proposed water gap in a side channel of the Verde River. The water gap is expected to be used for approximately 30 consecutive days between the months of July and October. The

intensity of livestock use of the water gap is expected to remain consistent during several hours mid-day, everyday, by approximately 10 to 15 head of cattle. The PNF proposes routine monitoring of the fence integrity to ensure restricted access to the Verde mainstem.

Conservation Measures/Management Objectives

The two primary management objectives exist for this allotment include an increase in 1) vegetative ground cover; and 2) frequency of perennial plants in areas where soil condition is noted as undesirable. To meet these objectives, fencing and water development improvements are proposed for the Perkinsville allotment. Specifically, approximately 7.75 miles of fence is to be constructed and used as either water gap fencing or interior division fencing, depending on management objective. Water development projects proposed for implementation include the construction and development of 3 wells and construction of 3.5 miles of pipeline and associated drinkers.

Additionally, the PNF will monitor the crossing site noted above every April for species presence/absence and biannually (spring and fall/winter) for assessment of primary habitat constituent elements. Should habitat conditions suffer adverse effects from livestock crossings, the PNF would initiate mitigation procedures.

Antelope Hills

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (~14,288 acres); Sycamore (~109 acres)
Consultation Period:	2002 through 2012; current permit expires on 12/31/08
Allotment Acres (capacities):	14,397 Total / 9,324 Full / 617 Potential / 4,456 No Capacity
Stocking Density (AUMs):	936 (current permitted) / 278-936 (current actual) / 624-1200 (proposed)
Livestock Kind:	Cow-calf
Proposed Grazing System:	Deferred rotation with variable numbers and season
Elevation (feet):	3500 - 5,424

Discussion: In 1972, livestock numbers were reduced by 51% due to deteriorating range conditions. Currently, the Antelope Hills allotment is supporting up to 1,200 AUMs (100 head of cattle) and will continue to do so through 2008 on 3 fenced pastures. The allotment is to be used year-round. The largest of the three pastures will be managed as four distinct grazing areas. Using a 40% vegetative utilization standard applied to key areas, a deferred rotation management system with variable numbers and seasons is proposed for this specific allotment.

Approximately 14.6 miles of the Verde River exists within this 14,397 acre allotment which is totally excluded from grazing. These 14.6 miles are designated critical habitat which are potentially occupied by spikedace.

Conservation Measures/Management Objectives

Two primary management objectives exist for this allotment. The objectives are to increase vegetative ground cover and frequency of perennial plants in areas where soil condition is noted as impaired (37.6% of allotment) or unsatisfactory (13% of allotment). These objectives are to be accomplished by improving livestock watering and limiting the intensity of use in areas of high grazing preference. Improving livestock watering is expected to provide more flexibility in rotation of livestock between grazing areas. Specifically, improvement of livestock watering facilities will be accomplished by 1) the installation of 22 storage tanks/drinkers throughout the allotment; 2) the installation of 5 miles of pipeline; and 3) the installation of an additional 2 drinkers off the pipeline.

Horseshoe

Forest:	Prescott
Ranger District:	Chino
5th Code Watershed(s):	Verde (acreage unknown)
Consultation Period:	2002 through 2011; current permit expires on 12/31/11
Allotment Acres (capacities):	14,646 Total / 9,333 Full / 1,660 Potential / 3,653 No Capacity
Stocking Density (AUMs):	2,700 (current permitted) / 1,032-2,220 (current actual) / 1,980-2,280 (proposed)
Livestock Kind:	Cow-calf

Proposed Grazing System: Deferred Rotation

Elevation (feet): 3,640 - 7,700

Discussion: The Horseshoe allotment is currently supporting up to 2,220 AUMs (190 head of cattle) and will continue to do so through 2011 on 2 winter/spring pastures and 7 summer/fall pastures. Grazing activity is managed under a deferred rotational system using a 30% vegetative utilization rate during the growing season and a 45% utilization rate during the dormant season.

Approximately 149 riparian acres, adjacent to 3.4 miles of designated critical habitat potentially occupied by spikedace on the Verde River, occur within the allotment and are excluded from livestock use and will continue to be monitored.

Conservation Measures/Management Objectives

The two primary management objectives for this allotment consist of increasing 1) vegetative ground cover; and 2) the frequency of perennial plants in areas where soil condition is noted as undesirable. To meet these objectives, several improvements are proposed for the Horseshoe allotment such as 1) the construction of 22 small water catchments designed to collect water runoff from roads and/or trails; 2) the construction of approximately 3.3 miles of fenceline; 3) the installation of a well and 19,200 feet of pipeline for remote livestock watering; and 4) the construction of water runoff control features and implementation of best management practices for runoff control.

<u>Verde River: Middle Reach</u>

Jerome

Forest: Prescott

Ranger District: Verde

5th Code Watershed(s): Verde (~30,448 acres), Granite Creek (~115 acres)

Consultation Period: 2002 through 2012; current permit expires on 12/31/06

Allotment Acres (capacities): 38,938 Total / 30,326 Full / 0 Potential / 8,612 No Capacity

Stocking Density (AUMs): 3,120 (current permitted) / 0-3,120 (current actual) / 3120 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Rest-rotation

Elevation (feet): 3,400 - 7,000

Discussion: The Jerome allotment is currently supporting up to 3,120 AUMs (181 head of cattle) and has proposed to continue through 2006 on 13 different pastures utilized at various times throughout the calendar year. Grazing activity is managed under a rest-rotational system using a 40% vegetative utilization rate during the growing season and 50% utilization rate during the dormant season for tobosa grass. Otherwise, a 35% utilization rate is applied for other species and a 20% utilization rate is applied to riparian areas.

No perennial stream miles reside within the Jerome allotment. However, several ephemeral channels exist which include the drainages for Black, Wilber, and Gladdis canyons.

Conservation Measures/Management Objectives

The PNF has proposed management objectives based on vegetative communities which occur within the allotment boundaries. For the desert grasslands occuring in the northern portion of the allotment, the PNF has proposed to increase ground cover, upgrade existing structures to antelope standards, and increase water availability. For the desert grasslands in the southern portion of the allotment, the PNF has proposed to manage for perennial grass vigor and reduce the increase of woody species. Management objectives for desert scrub community include addressing erosion, increasing ground cover, manage and increase riparian habitat, and implement the "Resource Access/Travel Management Plan . Management objectives for the chaparral community include sustaining pinyon pine, maintaining ground cover, and establishing herbaceous ground cover where not present. Management objectives for pinyon/juniper community involve simply maintaining the current status of the community. Management objectives for the riparian community involve the protection, improvement and managing for an increase of riparian habitat throughout the allotment. Management objectives for the ponderosa pine community include managing for vegetative diversity in promoting healthy grass communities, evaluating (for improvement) aspen stands, and identifying opportunities for the improvement of turkey habitat.

Verde

Forest: Prescott

Ranger District: Verde

5th Code Watershed(s): Verde (~21,286 acres)

Consultation Period: 2002 through 2009; current permit expires on 12/31/09

Allotment Acres (capacities): 21,286 Total / 17,096 Full / 0 Potential / 4,190 No Capacity

Stocking Density (AUMs): 2,256 (current permitted) / 2,000-2,256 (current actual) / 2,256 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Rest-rotation

Elevation (feet): 3,200 - 5,400

Discussion: The Verde allotment is currently supporting up to 2,256 AUMs (188 head of cattle), with one large herd utilizing four pastures. This action will continue through 2009. Three large pastures are used at varying times of the year for approximately 4-6 month intervals while a fourth, smaller pasture is used for up to 3 months at various times throughout the year as well. A small herd will utilize two additional pastures. Grazing activity is managed under a rest-rotational system using a 35% vegetative utilization rate during the growing season in conjunction with a 40% utilization rate on tobosa grass in the South pasture. A 50% utilization rate will be applied on sideoats gramma in dormancy.

No perennial stream reaches reside within the Verde allotment.

Conservation Measures/Management Objectives

In an effort to improve soil and range condition, a pipeline extension is planned (provided adequate funding) for the Gaddis Canyon pipeline which is expected to bring reliable water to Hull Hill Tank. Wilbur Canal and Double Troughs are also expected to provide additional water storage. Divide, Bootleg and Hull Hill South earthen tanks are also expected to be cleaned and lined as an improvement measure. In addition to water development, approximately 1.5 miles of fencing is proposed for installation east of Hwy 260. In combination, these measures will assist with livestock distribution and reduce localized grazing impacts.

Copper Canyon

Forest: Prescott

Ranger District: Verde

5th Code Watershed(s): Verde (~8,356 acres); Gap Creek (~1,709 acres)

Consultation Period: 2002 through 2012; current permit expires on 12/31/10

Allotment Acres (capacities): 10,065 Total / 5,873 Full / 0 Potential / 4,192 No Capacity

Stocking Density (AUMs): 1200 (current permitted) / 840-1200 (current actual) / 960 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Deferred Rotation

Elevation (feet): 3,400 - 4,100

Discussion: The Copper Canyon allotment is currently supporting up to 1,200 AUMs (100 head of cattle) and is proposed to continue through 2010 on 6 pastures (one of which is designated winter only). Cattle are rotated through four main pastures approximately every 2 - 4 months, year-round. The two additional pastures are smaller in size and will be used, in conjunction with the four larger pastures, for holding purposes. Grazing activity is managed under a deferred rotational system using a 40% vegetative utilization during the growing season, a 50% utilization rate during the dormant season, and a 20% utilization rate for riparian vegetation.

Approximately 180 riparian acres within the allotment are adjacent to Copper Creek, an intermittent stream of which 80 acres are fenced for exclusion from livestock. However, the remaining 100 riparian acres are used as winter pasture to limit use on riparian vegetation. The Verde River is not grazed on this allotment.

Conservation Measures/Management Objectives

Several improvements are proposed for the Copper Canyon allotment such as the installation of approximately one-half mile of drift fencing, the deepening of one groundwater well to establish a permanent water supply, and juniper thinning on 200 acres of the Tompkins pasture where juniper encroachment has been observed. Management objectives for this allotment are focused on maintianing or improving existing vegetative ground cover, in part to minimize effects to the southwestern willow flycatcher through maintenance of a cowbird buffer zone.

Young

Forest: Prescott

Ranger District: Verde (~880 acres)

5th Code Watershed(s): Gap Creek

Consultation Period: 2002 through 2012; current permit expires on 12/31/10

Allotment Acres (capacities): 800 Total / 841 Full / 0 Potential / 39 No Capacity

Stocking Density (AUMs): 108 (current permitted) / 0 - 108 (current actual) / 108 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Seasonal Use

Elevation (feet): 3,300 - 3,700

Discussion: The Young allotment is currently supporting up to 108 AUMs (9 head of cattle) and this use is proposed to continue through 2010 on a single pasture which is used at various times (four month intervals) throughout the calendar year. A utilization rate of 40% is proposed.

Due in part to its size and condition, this allotment is used as a swing pasture in coordination with irrigated private land.

There are no perennial reaches of surface water within the Young allotment and, consequently, no riparian vegetation zones or designated critical habitat.

Conservation Measures/Management Objectives

The management objective proposed for the Young allotment is to improve vegetative ground cover by following the prescribed utilization standards.

Squaw Peak

Forest: Prescott

Ranger District: Verde

5th Code Watershed(s): Gap Creek (~12,378 acres)

Consultation Period: 2002 through 2012; current permit expires on 12/31/05

Allotment Acres (capacities): 12,378 Total / 7,458 Full / 0 Potential / 4,920 No Capacity

Stocking Density (AUMs): 1,080 (current permitted) / 900-1,080 (current actual) / 900 (proposed)

Livestock Kind: Cow-calf

Proposed Grazing System: Rotation by elevation

Elevation (feet): 3,400 - 6,500

Discussion: The Squaw Peak allotment is currently supporting up to 1,080 AUMs (75 head of cattle) and is proposed to continue to do so through 2005 on 3 winter/spring pastures. Grazing activity is managed under a elevation-rotational system using a 50% vegetative utilization rate during the dormant season for tobosa grass and a 30% utilization rate is applied for other species, during the growing season.

The 61 riparian acres within the allotment are partially adjacent to 2 miles of the Verde River (excluded from livestock use) as well as 2 miles of Chasm Creek which is exposed to limited grazing (USFS 2001a). The 2 river miles of the Verde River are designated critical habitat which may be be potentially occupied by spikedace. The Verde River is fully excluded from grazing on this allotment.

Conservation Measures/Management Objectives

The primary management tool is to establish a rotation that will defer areas from grazing and follow utilization standards, so as to improve vegetative ground cover, especially to the extent soils and shrub cover allow at lower elevations on Squaw Peak allotment.

Verde River: Lower Reach

Brown Springs

Forest: Prescott

Ranger District: Verde

5th Code Watershed(s): Verde (acreage unknown), Gap Creek (acreage unknown), Coldwater Creek (acreage unknown)

Consultation Period: 2002 through 2012; current permit expires on 12/31/05

Allotment Acres (capacities): 16,044 Total / 8,526 Full / 0 Potential / 7,518 No Capacity

Stocking Density (AUMs): 2,040 cow 60 horse (current permitted) / 1,900-2,160 cow 48-72 horse (current actual) / 2,040 cow, 60 horse (proposed)

Livestock Kind: Cow-calf / Horse

Proposed Grazing System: Rotation

Elevation (feet): 3,400 - 6,600

Discussion: The Brown Springs allotment is currently supporting up to 2,160 AUMs (170 head of cattle and 6 horses) and is expected to continue doing so through 2005, on 3 pastures. Pastures are to be used year-round and managed under a rotational system. Various vegetative utilization standards are being applied based upon season and vegetative community. Specifically, a 35% utilization standard is being applied to key areas during the growing season; a 50% utilization standard is being applied during the dormant season; and a 20% utilization standard is being applied to riparian areas.

The Prescott NF is implementing a current management plan which incorporates utilization standards, improved livestock distribution and systematic deferment of grazing annually. Additionally, river monitoring is being conducted to assess percent utilization as cattle will be allowed to graze in unoccupied critical habitat within the allotment. Three main pastures are used for rotation of cattle at six month intervals ensuring that no pasture is grazed in successive years and to provide a minimum of twelve months of rest per pasture. Three smaller holding pastures are also used to assist in meeting range objectives.

Three waterbodies, the Verde River, Gap Creek, and Coldwater Creek exist within the allotment boundaries. Specifically, 12 miles of designated critical habitat on the Verde River, 8 miles of Gap Creek and 4 miles of Coldwater Creek (totaling 24 perennial stream miles) exist within the allotment. A total of 256 riparian acres are accessible to grazing activity. Ten perennial stream miles are accessible to grazing, or 42% of the total perennial stream miles.

There are two access points to the Verde River in the Coldwater and Rodeo pastures. Each pasture is grazed 5-6 months and rested for 12-14 months. The PNF monitors these areas for livestock effects which include vegetative utilization and impact to the river's banks. The monitoring occurs approximately three months into the grazing period and again after cattle have been removed from these pastures. The PNF has noted that riparian species utilization has been slight to low and bank destabilization does not appear to be occurring at the points of access.

Conservation Measures/Management Objectives

There are no specific proposed improvements for the Brown Springs allotment.

Sycamore

Forest:	Prescott
Ranger District:	Verde
5th Code Watershed(s):	Gap Creek (~204 acres), Agua Fria (~31,942 acres)
Consultation Period:	2002 through 2012; permit expires on 12/31/04
Allotment Acres (capacities):	32,146 Total / 27,733 Full / 2,652 Potential / 1,761 No Capacity
Stocking Density (AUMs):	6,360 (cows) 120 (horses) (both, previously permitted) / 6,360-6,465 (cows) 60-120 (horses) (both, previously actual) / 6,360 (cows) 120 (horses) (both, proposed)
Livestock Kind:	Cow-calf / Horses
Proposed Grazing System:	Rest-rotation
Elevation (feet):	4,000 - 6,800

Discussion: The Sycamore allotment has previously supported up to 6,465 AUMs (530 head of cattle and 10 horses). Currently the Sycamore allotment supports an AUM stocking density of 6,360 for cows and 120 horses through 2004 on 7 pastures. A main herd is to rotate through 4 pastures while a small herd is to rotate through 3 pastures in 4 month intervals. This system ensures that no pasture is grazed at the same time of year in successive years and provides a minimum of 12 months rest per pasture. Grazing activity is proposed to be managed under a rest rotational system using a 35% vegetative utilization rate for side oats grama, blue grama, and curly mesquite grass and 40% on tobosa grass during the growing season. A 50% utilization rate will be used for tobosa grass during the dormant season. A 20% utilization rate will be applied on riparian vegetation.

The 594 riparian acres within the allotment are adjacent to the approximate 2 to 3 miles of the intermittent Sycamore Creek. The perennial reaches of Sycamore Creek are excluded from livestock use and other reaches are inaccessible. The remainder of stream miles are managed under the rotational system. However, this opinion considers only the grazing management which occurs in allotments within the Verde 4th Code watershed. Therefore, only the 204 acres which occur within the Gap Creek 5th Code watershed (within the larger Verde 4th Code watershed) will be considered as part of this opinion.

The 594 riparian acres within the allotment are adjacent to the approximate 2 to 3 miles of the intermittent Sycamore Creek. Some of the perennial reaches of Sycamore Creek are excluded from grazing while others are included in pasture rotation (USFS 2001a).

Conservation Measures/Management Objectives

There are no primary management objectives proposed for the Sycamore allotment as vegetation and soils are near, at, or moving towards allotment management plan objectives.

STATUS OF THE SPECIES/CRITICAL HABITAT

Spikedace

Spikedace was listed as a threatened species on July 1, 1986 (USFWS 1986a). Critical habitat was designated for spikedace on March 8, 1994 (USFWS 1994a), but was set aside by order of the Federal courts in Catron County Board of Commissioners, New Mexico v. U.S. Fish and Wildlife Service, CIV No. 93-730 HB (D.N.M., Order of October 13, 1994). Critical habitat was subsequently revoked by the Service (USFWS 1998a). It was again designated on April 25, 2000 (USFWS 2000). 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.

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 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).

When critical habitat was designated, the Service determined the primary constituent elements for spikedace. Constituent elements include those habitat features required for the physiological, behavioral, and ecological needs of the species. For spikedace, these include:

1) Permanent, flowing, unpolluted water;

2) Living areas for adult spikedace with slow to swift flow velocities in shallow water with shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand and gravel bars, and eddies at downstream riffle edges;

3) Living areas for juvenile spikedace with slow to moderate flow velocities in shallow water with moderate amounts of instream cover;

4) Living areas for larval spikedace with slow to moderate flow velocities in shallow water with abundant instream cover;

5) Sand, gravel, and cobble substrates with low to moderate amounts of fine sediment and substrate embeddedness;

6) Pool, riffle, run, and backwater components present;

7) Low stream gradient;

8) Water temperatures in the approximate range of 1-30°C (35-85°F) with natural diurnal and seasonal variation;

9) Abundant aquatic macroinvertebrate food base [prey may include the taxa Ephemeroptera, Chironomidae, and Trichoptera (Sublette *et al.*1990)];

10) Periodic natural flooding;

11) A natural, unregulated hydrograph or, if the flows are modified or regulated; then a hydrograph that demonstrates an ability to support a native fish community; and

13) Habitat devoid of nonnative aquatic species detrimental to spikedace, or habitat in which detrimental nonnative species are at levels which allow persistence of spikedace.

The constituent elements are generalized descriptions and ranges of selected habitat factors that are critical for the survival and recovery of spikedace. The appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level, or value of the constituent elements must

include consideration of the season of concern and the characteristics of the specific location. The constituent elements are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the constituent elements need to be assessed in relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrologic patterns, and overall aquatic faunal community structure.

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, Tibbets 1993).

The status of spikedace is declining rangewide. 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 1994a).

Loach Minnow

Loach minnow was listed as a threatened species on October 28, 1986 (USFWS 1986b). Critical habitat was designated for loach minnow on March 8, 1994 (USFWS 1994b), but was set aside by order of the Federal courts in Catron County Board of Commissioners, New Mexico v. U.S. Fish and Wildlife Service, CIV No. 93-730 HB (D.N.M., Order of October 13, 1994). Critical habitat was subsequently revoked by the Service (USFWS 1998a). It was again designated on April 25, 2000 (USFWS 2000). 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.

Loach minnow is a small, slender, elongate fish with markedly upwardly-directed eyes (Minckley 1973). 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, Dry Blue, Pace, Frieborn, Negrito, Whitewater and Coyote 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, Bagley *et al*. 1995, USBLM 1995, Bagley *et al*. 1996, 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 the 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). Loach minnow feeds exclusively on aquatic insects (Schrieber 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).

When critical habitat was designated for loach minnow, the Service determined the primary constituent elements for loach minnow. These elements include:

1) Permanent, flowing, unpolluted water;

2) Living areas for adult loach minnows with moderate to swift flow velocities in shallow water with gravel, cobble, and rubble substrates;

3) Living areas for juvenile loach minnows with moderate to swift flow velocities in shallow water with gravel, cobble, and rubble substrates;

4) Living areas for larval loach minnows with slow to moderate flow velocities in shallow water with sand, gravel, and cobble substrates and abundant instream cover;

5) Spawning areas for loach minnow with slow to swift flow velocities in shallow water with uncemented cobble and rubble substrate;

6) Low amounts of fine sediment and substrate embeddedness;

7) Pool, riffle, run, and backwater components present;

8) Low to moderate stream gradient;

9) Water temperatures in the approximate range of 1-30°C (35-85°F) with natural diurnal and seasonal variation;

10) Abundant aquatic macroinvertebrate food base [prey may include chironomids, simuliids, ephemeropterans, plecopterans, and tricopterans and juvenile loach minnows generally take chironomids (Sublette *et al.* 1990)] ;

11) Periodic natural flooding;

12) A natural, unregulated hydrograph or, if the flows are modified or regulated; then a hydrograph that demonstrates an ability to support a native fish community; and

13) Habitat devoid of nonnative aquatic species detrimental to loach minnow, or habitat in which detrimental nonnative species are at levels which allow persistence of loach minnow.

These constituent elements are generalize descriptions and ranges of selected habitat factors that are critical for the survival and recovery of loach minnow.

As noted under spikedace, the appropriate and desirable level of these factors may vary seasonally and is highly influenced by site-specific circumstances. Therefore, assessment of the presence/absence, level, or value of the constituent elements must include consideration of the season of concern and the characteristics of the specific location. The constituent elements are not independent of each other and must be assessed holistically, as a functioning system, rather than individually. In addition, the constituent elements need to be assessed in relation to larger habitat factors, such as watershed, floodplain, and streambank conditions, stream channel geomorphology, riparian vegetation, hydrologic patterns, and overall aquatic faunal community structure.

Recent biochemical genetic work on loach minnow indicate that 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 rangewide. 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 1994c).

Critical Habitat

The Verde River complex, which is comprised of the Verde River in conjunction with its main tributaries, has been segregated into six distinct geographical units based upon relative proximity to a major tributary or the Verde River itself. Critical habitat includes 106 miles of the Verde River, extending from Sullivan Dam downstream to the confluence with Fossil Creek. Critical habitat has also been designated in the 5th code watersheds within the action area, specifically in major tributaries to the Verde River. These tributaries include Fossil Creek (5 miles), West Clear Creek (7 miles), Beaver/Wet Beaver Creek (21 miles), Oak Creek (34 miles), and Granite Creek (1.4 miles). The tributary streams within the Verde River complex are believed to be unoccupied

at the present time although they offer potential habitat for either or both spikedace and loach minnow (USFWS 2000). The relatively stable hydrologic and thermal regimes of the Verde River complex are comparatively unique to other river systems of the arid southwestern United States (USFWS 2000). The combination of these factors provides a promising prospect of future reintroduction efforts for these species within the unoccupied reaches residing in the Verde River complex. The following specifically describes the six water bodies included in the Verde River complex which contain designated critical habitat for the spikedace:

Verde River: Approximately 106.5 miles of the Verde mainstem is designated critical habitat from the confluence with Fossil Creek in GSRM, T.11N., R.6E., NE¼ Sec. 25 upstream to Sullivan Dam in GSRM, T.17N.,R.2W., NW¼ Sec. (USFWS 2000). The perennial flow within this reach is generated by a series of river channel springs and discharge from Granite Creek (USFWS 2000).

Fossil Creek: Approximately 4.7 miles of the creek is designated critical habitat from the confluence with the Verde River mainstem in GSRM, T.11N., R.6E., NE¼ Sec. 25 to the confluence with an unnamed tributary from the northwest in GSRM, T.11½N., R.7E., center Sec. 29 (USFWS 2000). Lower Fossil Creek contains all primary constituent elements for spikedace with the exception of adequate discharge due to diversion of water for use at the local Childs/Irving Hydropower site (USFWS 2000).

West Clear Creek: Approximately 7.2 miles of the creek is designated as critical habitat for spikedace extending from the confluence with the Verde mainstem in GSRM, T.13N., R.5E., center Sec. 21 upstream to the confluence with Black Mountain Canyon in GSRM, T.13N., R.6E., SE¼ Sec. 17 (USFWS 2000). The lower portion of this tributary historically supported spikedace and currently offers suitable, although degraded, habitat for the species (USFWS 2000).

Beaver\Wet Beaver Creek: Approximately 20.8 miles of the creek is designated as critical habitat extending from the confluence with the Verde mainstem in GSRM, T.14N., R.5E., SE¼ Sec. 30 upstream to the confluence with Casner Canyon in GSRM, T.15N., R.6E., NW¼ Sec. 23 (USFWS 2000). The lower portion of this tributary historically supported spikedace and currently offers potential habitat that is currently degraded (USFWS 2000).

Oak Creek: Approximately 33.8 miles of the creek is designated as critical habitat extending from the confluence with the Verde mainstem in GSRM, T.15N., R.4E., SE¼ Sec. 20 upstream to the confluence with an unnamed tributary to the south in GSRM, T.17N., R.5E., SE¼, NW¼ Sec. 24 (USFWS 2000). Within the historical range of spikedace, the lower portion of this tributary formerly supported spikedace and currently offers suitable, however degraded, habitat (USFWS 2000).

Granite Creek: Approximately 1.4 miles of the creek is designated as critical habitat for the loach minnow extending from the confluence with the Verde mainstem in GSRM, T.17N., R.2W., NE¼ Sec. 14 upstream to a natural spring source in GSRM, T.17N.,

R.2W., SW¼, SW¼ Sec. 13 (USFWS 2000). This spring-fed perennial tributary is considered an important expansion area for spikedace in the upper Verde River (USFWS 2000).

The following specifically describes six water bodies included in the Verde River complex which contain designated critical habitat for the loach minnow:

Verde River: Approximately 106.5 miles of the Verde mainstem is designated critical habitat from the confluence with Fossil Creek in GSRM, T.11N., R.6E., NE¼ Sec. 25 upstream to Sullivan Dam in GSRM, T.17N.,R.2W., NW¼ Sec. 15, excluding lands belonging to the Yavapai Apache Tribe (USFWS 2000). The perennial flow within this reach is generated by a series of river channel springs and discharge from Granite Creek (USFWS 2000).

Fossil Creek: Approximately 4.7 miles of the creek is designated critical habitat from the confluence with the Verde River mainstem in GSRM, T.11N., R.6E., NE¼ Sec. 25 to the confluence with an unnamed tributary from the northwest in GSRM, T.11½N., R.7E., center Sec. 29 (USFWS 2000). Lower Fossil Creek contains all primary constituent elements for loach minnow with the exception of adequate discharge due to diversion of water for use at the local Childs/Irving Hydropower site (USFWS 2000).

West Clear Creek: Approximately 7.2 miles of the creek is designated as critical habitat for spikedace extending from the confluence with the Verde mainstem in GSRM, T.13N., R.5E., center Sec. 25 upstream to the confluence with Black Mountain Canyon in GSRM, T.13N., R.6E., SE¼ Sec. 17 (USFWS 2000).

Beaver\Wet Beaver Creek: Approximately 20.8 miles of the creek is designated as critical habitat extending from the confluence with the Verde mainstem in GSRM, T.14N., R.5E., SE¼ Sec. 30 upstream to the confluence with Casner Canyon in GSRM, T.15N., R.6E., NW¼ Sec. 23 (USFWS 2000). The lower portion of this tributary historically supported loach minnow and currently offers potential habitat that is currently degraded (USFWS 2000).

Oak Creek: Approximately 33.8 miles of the creek is designated as critical habitat extending from the confluence with the Verde mainstem in GSRM, T.15N., R.4E., SE¼ Sec. 20 upstream to the confluence with an unnamed tributary to the south in GSRM, T.17N., R.5E., SE¼, NW¼ Sec. 24 (USFWS 2000). Within the historical range of loach minnow, the lower portion of this tributary formerly supported loach minnow and currently offers suitable, but degraded, habitat (USFWS 2000).

Granite Creek: Approximately 1.4 miles of the creek is designated as critical habitat for the loach minnow extending from the confluence with the Verde mainstem in GSRM, T.17N., R.2W., NE¼ Sec. 14 upstream to a natural spring source in GSRM, T.17N., R.2W., SW¼, SW¼ Sec. 13 (USFWS 2000). This spring-fed perennial tributary contains suitable habitat for loach minnow in the upper Verde River (USFWS 2000).

ENVIRONMENTAL BASELINE

General Discussion

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 actions now under consultation.

Part of the Colorado River system, the Verde River is a tributary to the Salt River and is embedded in a myriad of land ownership including private, Tribal, State and Federal land. Approximately 400,000 and 60,000 acres of land within the Verde drainage are managed by the Prescott NF and Kaibab NF, respectively (USFS 2001b).

The Verde River drainage has annual precipitation amounts which range from 12.2 to 18.1 inches. Winter precipitation events, originating in the Pacific Ocean, are marked by slow, sustained rain and/or snow fall while monsoon precipitation (typically from July through September) originates from the Sea of Cortez and the Gulf of Mexico and is characterized as flashy, high intensity events. Expectedly, the most severe soil erosion occurs during the monsoon.

The Verde River, designated critical habitat for spikedace and loach minnow, enters the action area approximately 8 miles downstream of its source, approximately where Muldoon Canyon meets the Verde River, and exits the action area at the boundary between the Prescott and Tonto National Forests just southeast of Childs, Arizona. It should be noted that a significant amount of private and State-owned land exists in the Verde watershed within the middle and lower reaches, adjacent to the 100-year floodplain, and is not considered part of the action area. However, the Verde River itself, including the 100-year floodplain, is considered part of the action area as it river passes through this general area.

Specific environmental baseline descriptions are provided below for the individual allotments. Each allotment is organized based upon its proximity to, or location on, the Verde River (upper reach, middle reach, lower reach) as follows:

Verde River: Upper Reach

A total of nine allotments and approximately 37.6 miles of critical habitat occur within the upper reach of the Verde River. Some, not all, of these nine allotments are adjacent to critical habitat. Specifically, these allotments include the Limestone, West Bear/Del Rio, Muldoon, China Dam, Sand Flat, Tule, Perkinsville, Horseshoe, and Antelope Hills allotments. It is useful, in assessing the overall conditions of the uplands, to examine soil conditions that indicate the sensitivity of

the ground surface to precipitation events and their subsequent ability to minimize erosion and transportation of sediment to stream channels. To better assess the conditions of the uplands as a whole, in factoring the conditions observed in each allotment, the average soil condition rating for the upper reach of the Verde River watershed was calculated by the PNF. According to said calculations, soil conditions in the upper reach of the Verde River were determined to be 36.8% satisfactory, 34.6% impaired, and 28.6% unsatisfactory (figures rounded to the nearest 10th percentile).

A variety of vegetation assemblages occur within the nine allotments residing within the upper reach of the Verde River. Forb species which may be present include showy bur-marigold, white sweetclover, cutleaf water parsnip, knotgrass, cocklebur, cudweed sp., western ragweed, velvet weed gaura, annual saltmarsh aster, and yellow sweet clover (USFS 2001b). Emergent species which may be present within these allotments include common spike sedge, cattail/angustifolia, *Scirpus pungens*, Baltic rush, three square bulrush, whorled marsh pennywort, horsetail, and smooth horsetail (USFS 2001b). Grass species observed include rice cutgrass, knotgrass, inland saltgrass, rabbitfoot polypogon, western wheatgrass, bermuda grass, alkali muhly, reed canary grass, and Japanese brome (USFS 2001b). Woody species encountered may include seep willow, netleaf hackleberry, velvet ash, box elder, Goodding willow, golden currant, stretch berry, salt cedar, juniper, robinia, canyon grape, Bonpland willow, and Freemont cottonwood (USFS 2001b).

Limestone Allotment

While portions of two 5th code watersheds (Hell Canyon and Granite Creek) exist within the 57,627 acre Limestone allotment, no perennial stream reaches lie within the boundaries of the allotment and consequently, no designated critical habitat for either species exists within the allotment. The Limestone allotment is comprised of approximately 7% grasslands and 93% pinyon-juniper.

In the past as stated previously herein, permitted stocking rates were drastically reduced on the Limestone in 1988 from a high of 9,710 AUMs to 918 AUMs currently. This 91% reduction stemmed from a continued downward trend in range condition, a rating of poor to very poor on nearly all acres, unacceptable soil loss on some acres, and a desire by the Prescott NF to realize the moderate re-vegetation potential on one-half of the allotment.

Some issues of particular interest have been identified for this allotment. One concern for the Limestone allotment is the documented juniper encroachment on several acres within the allotment. In 1988, juniper treatment was approved for approximately 500 acres. Within the treated area(s), juniper canopies have increased and remain high on untreated areas. Juniper encroachment crowds-out perennial grass species through shading and consequently compromises the soil's ability to slow runoff of and enhance infiltration of water during precipitation events. Additionally, the Prescott National Forest noted that reliable water, and opportunities to develop water, are naturally very limited on the allotment.

West Bear/Del Rio Allotment

Four main vegetation types have been described within the 72,315 total acres of the West Bear/Del Rio allotment. These vegetation types consist of grassland (20,651 acres or 29% of total area), pinyon-juniper (49,502 acres or 68% of total area), oak-mahogany (1,851 acres or 3% of total area), and riparian (311 acres or 0.4% of total area). The 311 riparian acres within the allotment are adjacent to 9.7 miles of the Verde River which is designated as critical habitat for spikedace and loach minnow and is potentially occupied by spikedace. No loach minnows are known to currently exist within this segment. This perennial segment is excluded from livestock use and monitored for stray cattle. This 9.7 mile reach has been classified as "functional at risk, with an upward trend using the Proper Functioning Condition (PFC) stream assessment protocol. It should be noted that, although the PFC assessment indicated improving conditions along this 9.7 mile segment of the Verde River, PFC assessments are designed for the evaluation of riparian characteristics and the associated effect on stream channel morphology, and do not specifically assess the condition of the aquatic habitat.

Soil conditions for the West Bear allotment can be summarized as 14.6% satisfactory, 34.3% impaired, and 51% unsatisfactory. Soil conditions for the Del Rio allotment can be summarized as 25.8% satisfactory, 28.4% impaired, and 45.8% unsatisfactory. This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Muldoon Allotment

Portions of three 5th code watersheds occur within the 25,067 acre Muldoon allotment. These watersheds include Granite Creek (17,810 total acres), Verde (6,086 total acres), and Hell Canyon (99 acres). Approximately 3.6 perennial stream miles (Verde River) within the allotment boundaries are designated as critical habitat for spikedace and loach minnow, which may potentially be occupied by spikedace at this time.

Three main vegetation types exist within the Muldoon allotment. These vegetation types consist of grasslands (2,709 acres or 11% of total area), pinion-juniper/browse (21,110 acres or 84% of total area), and riparian (176 acres or 1% of total area).

In the April 30, 2001, BE, the USFS offered a brief synopsis of vegetation and plains condition for three distinct grazing areas within the Muldoon allotment. These areas consist of the Valley Plains (10% of the allotment), Elevated Plains and Plains (6% and 13% of the allotment respectively), and Hills (48% of allotment).

The Valley Plains are comprised of grasslands, scattered shrubs, and juniper stands. Despite the Valley Plains high production potential, soil function is limited by compaction, sheet erosion, gullies, poor nutrient cycling and sparse vegetative cover. These characteristics are symptoms of poor watershed condition and are attributable to factors including, but not limited to, historic

livestock management and juniper encroachment. Specifically, the production potential for grass cover is five times higher than present conditions.

Unlike the Valley Plains, juniper woodlands dominate the Elevated Plains and Plains regions of the Muldoon allotment. Prickly pear and various grass species are also present within these regions. Bare soil is noted as excessive, partially due to low amounts of exposed rock as compared to other regions within the allotment. Soil function has been rated as below potential as a result of sparse distribution of organic matter and compaction which limits moisture infiltration.

Lastly, the Hills region of the Muldoon allotment is predominantly classified as pinyon-juniper woodland. Overall soil function and productivity are being sustained. Grass species diversity is low, however, percent grass cover is rated as adequate.

The entire Muldoon allotment soil condition rated as 42.6% satisfactory, 36.3% impaired, and 21.1% unsatisfactory. Currently, two major issues define the Muldoon allotment's condition. First, as stated previously, limited soil function on the Valley Plains and Elevated Plains, traditionally used for livestock grazing, is exacerbated by the synergistic effects of compaction, sheet erosion, and poor vegetative ground cover. Secondly, livestock distribution is limited due to few water developments, and unequal pasture capacity limits the ability to implement deferred grazing regimes on this particular allotment.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

China Dam Allotment

Current soil conditions in the 15,947 acre China Dam allotment are differentiated as 36.4% in satisfactory condition, 53.2% in impaired condition and 10.4% in unsatisfactory condition with three main vegetation types present. These vegetation types consist of grasslands (795 acres or 5% of total area), pinyon-juniper (14,741 acres or 92% of total area), and riparian (116 acres or 1% of total area).

The PNF provided an assessment of watershed conditions for the three main vegetative areas, Valley Plains, Elevated Plains and Hills, present on the allotment. The Valley Plains, 5% of the allotment, is experiencing limited soil function due to compaction resulting in reduction of infiltration capacity. Ecological inventory data has shown vegetative litter at equal to or greater levels than expected on 75% of TES plots (USFS 2001a). Vegetative ground cover is also noted as higher than expected in some areas. However, bare soil remains a problem on this area of the allotment at 47 - 78%. The combination of these conditions has resulted in excessive gully erosion. The PNF stated that "While old roads and road drainage may have initiated and contribute to some of these gullies, continued livestock concentration in valley bottoms is accelerating the erosion process (USFS 2001a).

The Elevated Plains and Plains portion of the allotment (45%) presently has a wide variety of soil type and function. Specifically, approximately 62% of the plains are experiencing localized erosion, soil compaction and limited organic cover (USFS 2001a). These characteristics may be attributable to various factors which may include historic livestock management, juniper encroachment, or the presence of primitive roads in the vicinity. The remaining area is either comprised of soils which are properly functioning (34%) or are defined as having natural erosion characteristics with limited function (4%) (USFS 2001a).

The Hills portion of the allotment (40%) is also experiencing limited soil function due to "localized erosion, compaction and lack of organic matter for nutrient cycling (USFS 2001a). Vegetative ground cover is higher than TES predictions; basal plant cover is consistent with TES predictions and litter cover varies but it is generally higher on most plots.

Implementation of winter grazing has benefitted perennial grass species as evidenced by increased plant litter and frequency on all four Parker transects within the allotment. However, high lime content in soils is proving to be a limiting factor in the ability for grazed areas to fully recover. A trend in juniper encroachment (0.5 to 4.5 times higher) has been noted in several TES units within the allotment (USFS 2001a). Other TES results indicated excessive areas of bare soil, with increasing intensity with proximity to watercourses.

While two 5th code watersheds exist within the China Dam allotment, only the Verde River exists as a perennial waterbody. Specifically, 3 miles of the Verde River, designated critical habitat for spikedace and loach minnow, lies within the allotment. Of the two species, only spikedace may potentially occur within this 3-mile segment of critical habitat. A total of 116 riparian acres are present on the allotment but are not accessible to grazing activity and are being monitored for stray cattle to ensure exclusion. The PNF has noted that poor distribution of cattle and limited water development contribute to the inability to manage cattle using deferment and rotation.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Sand Flat Allotment

Three main vegetation types exist within the 23,111 acre Sand Flat allotment. These vegetation types consist of pinyon-juniper (19,388 acres or 84% of total area), browse (3,676 acres or 16% of total area), and riparian (47 acres or 0.2% of total area). The 47 riparian acres within the allotment are adjacent to 1.7 miles of the Verde River which is designated as critical habitat for spikedace and loach minnow. However, only spikedace may potentially occupy this segment of critical habitat. Livestock are excluded from this critical habitat and it is monitored for stray cattle. This 1.7 mile reach has been classified as "functional at risk, with an upward trend using a PFC stream assessment. The PFC assessment indicated improving conditions of riparian characteristics and the associated effect on stream channel morphology, but does not specifically address the condition of the aquatic habitat.

Soil conditions for the Sand Flat allotment can be summarized as 42.8% satisfactory, 38.3%

impaired, and 18.9% unsatisfactory. While animal months grazed have been successfully reduced over the years to a current level of between 630 and 1500 AUMs, undesirable soil conditions remain a principle concern for most of this allotment. Complicating matters, the juniper canopy is high, and increasing, and herbaceous understory potential remains low where juniper canopy exceeds 25%. This scenario has direct affects on the ability of the soil to absorb precipitation, avoid excessive sheet runoff, and curb sediment transport.

The Sand Flat allotment is comprised of three basic landforms, the Valley Plains (2%), Plains (38%), and Hills (60%). The soil properties which allow for proper infiltration and retention of moisture, resistence to erosion, and nutrient cycling are either absent or significantly lacking in areas of the Valley Plains and Plains. Litter and basal plant cover, components of vegetative ground cover, are less than TES survey predictions by 3 - 18% and 5 - 21% respectively (USFS 2001a). A large amount of bare ground present in these areas is a symptom of a combination of factors including less exposed rock and limited vegetative ground cover. Areas of the Valley Plains and Plains regions of the Sand Flat allotment are also characterized by juniper encroachment, effectively choking-out herbaceous plant communities.

The Hills region of the allotment was assessed as two distinct zones, "juniper not limiting and "juniper limiting by the PNF. The areas distinguished as "juniper not limiting ar e classified as having functioning soils despite the fact that basal plant cover and litter were quantified at slightly below TES potentials and bare soil was elevated by 23-50% TES predictions (USFS 2001a). The "juniper limiting areas of the Hills region were assessed as having reduced soil function which is attributed to a dense juniper canopy and a lack of nutrient cycling (USFS 2001a).

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Tule Allotment

Three main vegetation types exist within the 60,309 acre Tule allotment. These vegetation types consist of grassland (6,031 acres or 10% of total area), pinyon-juniper (12,062 acres or 20% of total area), and ponderosa (42,216 acres or 70% of total area).

Range condition for the Tule allotment is summarized by acres per condition rating. Approximately 3,015 acres are considered in "good condition, 21,108 acres are in "fair condition, 24,124 acres are in "poor condition, and 12,062 acres are in "very poor condition. However, trends in vegetation condition are upward/stable on most of the allotment, according to the Kaibab National Forest. Generally speaking and as noted in the BE, significant AUM reductions, adjustments in pasture rotation schemes, and construction of numerous water sources has improved range condition as evidenced by an approximate doubling of effective ground cover (USFS 2001a). This improvement in watershed conditions was likely initiated in 1978 when the cattle grazing was reduced by some 40%, coupled with intensified management.

Vegetative and soil condition trend analyses of the various vegetative communities has indicated an upward trend in the pinyon/juniper woodlands, a stable to upward trend in the grasslands and a slightly upward trend in the ponderosa woodlands which is slightly hampered by an increasing canopy (USFS 2001a).

According to the PNF, there are no perennial stream reaches within the Tule allotment and, hence, no designated critical habitat for either spikedace or loach minnow.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Perkinsville Allotment

Five main vegetation types have been identified within the 51,692 acre Perkinsville allotment. These vegetation types consist of grasslands (8,414 acres or 16% of total area), pinyon-juniper (13,768 acres or 27% of total area), pinyon-juniper-oak (16,363 acres or 32% of total area), chaparral (5,858 acres or 11%) and riparian (417 acres or 1% of total area).

Soil conditions for the Perkinsville allotment can be summarized as 35.2% satisfactory, 21.1% impaired, and 43.7% unsatisfactory. The PNF has noted several issues of concern pertaining to range condition and potential on this allotment. These issues included:

1) Threatened/Endangered/ Proposed (TEP) species and critical habitat present on the Verde River;

2) Localized off-road vehicle use; heavy use of dispersed camping spots at Perkinsville Bridge, trash being dumped on the allotment;

3) Backlog of recreational trail maintenance in Sycamore Wilderness;

4) Increasing frequency of Russian knapweed, an aggressive non-native plant;

5) Juniper canopies are increasing. Where juniper canopy approaches 25% or greater, there is little herbaceous understory;

6) Impaired soils dominate the plains. Juniper is notably increasing on this landform. Another 33% of plains have unsatisfactory sandstone soils that are inherently erosive;

7) Livestock are exhibiting species-selective grazing behavior under the current extensive management system; and

8) There are few reliable water developments, limiting opportunities to develop

pastures for shorter grazing periods and affecting deferred rotation during periods of spring growth.

The PNF conducted trend analyses for vegetation and soil condition on the three main land forms within the Perkinsville allotment. These land forms are the Valley Plains, the Plains, and the Hills. A stable trend has been observed on the Valley Plains with increased litter and decreased bare soil. The Plains were observed as having a sharp decline in herbaceous plant frequency during the 1970's which gradually stabilized from the 1980's to present. The Plains also experienced an increase in overstory and litter coupled by an stable or slightly declining trend in the frequency of bare soil. The Hills experienced a decline in herbaceous plant frequency, fluctuating trends in bare soil and an increasing trend in litter. Juniper overstory was also noted as increasing.

Approximately 1.6 perennial miles of the Verde River traverse this allotment. This segment is classified as designated critical habitat for both spikedace and loach minnow and may potentially be occupied by spikedace at this time.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Antelope Hills Allotment

Approximately 14.6 miles of the Verde River exists within this 14,397 acre allotment which is totally excluded from grazing. These 14.6 miles are considered as designated critical habitat for both spikedace and loach minnow and may potentially be occupied by spikedace. Four main vegetation types exist within the Antelope Hills allotment. These vegetation types consist of grasslands (3,800 acres or 26% of total area), pinyon-juniper (6,859 acres or 48% of total area), browse/chaparral (2,817 acres or 20% of total area), and riparian (767 acres or 5% of total area) (USFS 2001a).

The soil conditions for the Antelope Hills allotment are considered 49.4% satisfactory, 37.6% impaired and 13% unsatisfactory, according to the PNF (USFS 2001a).

The PNF provided an assessment of watershed conditions for the three main vegetative areas, Valley Plains and Plains (15% of the allotment), Hills (35% of the allotment), and Escarpments (47% of the allotment) residing within Antelope Hills (USFS 2001a). The Valley Plains and Plains area is experiencing limited soil function as defined by increased areas of bare soil, a lack of organic matter on the soil surface, areas of high compaction, and a lack of proper nutrient cycling (USFS 2001a). Active gully erosion has also been noted in the Valley Plains and Plains. This gullying action may be the result of the naturally erosive sandstone component which dominates the soils present in this area. The clayey soils present in this region are characterized by slow infiltration and percolation rates and when accompanied by high compaction and increased bare soil, increase runoff and erosion rates (USFS 1996). However, increasing

vegetative matter growing in the gullies is evidence of a potential stabilizing trend. While juniper encroachment is not currently limiting watershed condition, it is anticipated to become a problem within the next ten years (USFS 2001a).

The Hills region is comprised of well-armored rocky areas with soil loss below tolerance levels (USFS 2001a). Trends in erosion in the Hills can be described as low levels of sheet erosion, accompanied by inherently rapid runoff on clay soils during flashy precipitation events and an accelerated trend gully erosion at the toe of steeper slopes, most notably where vegetative ground cover is lacking (USFS 2001a).

The Escarpments have multiple trends occurring for similar constituents in watershed condition. Two Ecological Inventory (EI) plots displayed higher litter and bare soil where grazing has not occurred (USFS 2001a). Alternatively, two other EI plots showed litter approaching TES potential with increasing bare soil where cattle have grazed. Basal vegetation was also observed with various trends. Some plots experienced basal vegetation near TES potential while others where approximately half the TES potential.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Horseshoe Allotment

Approximately 3.4 miles of the Verde River exists within this allotment which is totally excluded from grazing as well as monitored for stray cattle. These 3.4 miles are designated critical habitat for both spikedace and loach minnow. However, only spikedace are believed to be potentially occupying this segment of the Verde River.

Four main vegetation types have been described within the 14,646 acre Horseshoe allotment. These vegetation types consist of grasslands (3,379 acres or 23% of total area), pinyon-juniper (8,761 acres or 60% of total area), oak-mahogany (2,357 acres or 16% of total area), and riparian (149 acres or 1% of total area) (USFS 2001a).

Soil conditions for the Horseshoe allotment can be summarized as 47.4% satisfactory, 27.4% impaired, and 25.2% unsatisfactory. Trend analysis offered by the PNF has indicated an upward trend in litter and plant frequency and a downward trend in bare soils (USFS 2001a). The Baker's Pass Ecosystem Management Project delineated the Horseshoe allotment (as well as the Antelope Hills allotment) into six ecological land units. These units include the Alluvial Plains, Elevated Plains, Chaparral Formation, Escarpments, Hills, and the Verde River (USFS 1996).

The Alluvial Plains is exposed to inherently high runoff rates from adjacent uplands during heavy precipitation events and the soils are characterized as high in silt and sands with a friable structure (USFS 1996). Therefore, where vegetative ground cover is low, accelerated gully erosion occurs. Furthermore, areas of low vegetative ground cover increase the likelihood for fine sediments to be transported significant distances, including the cumulative addition of sediments from gullies and ephemeral channels, ultimately to the Verde River (USFS 1996).

The Verde River unit residing within the Horseshoe allotment receives sediment delivered from the sub-watersheds which is inherently high in fines (USFS 1996). The PNF has noted that "past improper grazing practices have lowered the capacity of the sedges to aggregate sediments which lowers riparian function in terms of mitigating sedimentation (USFS 1996).

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Verde River: Middle Reach

A total of five allotments occur within the middle reach of the Verde River. Specifically, these allotments from north to south include the Jerome, Verde, Copper Canyon, Young, and Squaw Peak allotments. As noted in the upper reach of the Verde River, in assessing the overall conditions of the uplands, it is useful to examine soil conditions as soil conditions indicate the sensitivity of the ground surface to precipitation events and their subsequent ability to minimize erosion and transportation of sediment to stream channels. To better assess the conditions of the uplands as a whole, in factoring the conditions observed in each allotment, the average soil condition rating for the upper reach of the Verde River watershed was calculated by the PNF. According to these calculations, watershed conditions in the action area in the middle reach of the Verde River watershed were determined to be 45.9% satisfactory, 50.7% unsatisfactory, and 3.3% impaired (figures rounded to the nearest 10^{th} percentile).

Of the three distinct reaches on the Verde River corridor, the middle reach is characterized as mostly privately-owned land. Grazing management on privately-owned land is not regulated and may be at risk of excessive deterioration of watershed conditions for this reason. However, these impacts are difficult to assess due to the complicated nature of assessing impacts to the aquatic habitat from watershed conditions of uplands of various ownership and management protocols. The middle reach is also designated critical habitat for spikedace and loach minnow, although loach minnow are not presently occupying this reach. However, the PNF has indicated that spikedace may potentially be occupying this reach (USFS 2001a, USFS 2001b).

Diversified vegetative communities occur within the five allotments residing within the middle reach of the Verde River. Forb species which may be present include showy bur-marigold, cutleaf, water parsnip, cocklebur, western ragweed, annual saltmarsh aster, curleytop knotweed, Kochia, and yellow sweetclover (USFS 2001b). Emergent species which have been accounted for within these allotments include spike sedge, cattail, Baltic rush, three square bulrush, American bulrush, horsetail, *Carex senta*, and black flatsedge (USFS 2001b). Grass species observed include rice cutgrass, knotgrass, rabbitfoot polypogon, western wheatgrass, and bermuda grass (USFS 2001b). Woody species encountered may include seep willow, coyote willow, velvet ash, box elder, Gooddings willow, salt cedar, juniper, and Freemont cottonwood (USFS 2001b).

Jerome Allotment

Four main vegetation types exist within the 38,938 acre Jerome allotment. These vegetation types consist of grasslands (17,326 acres or 44% of total area), pine (4,000 acres or 10% of total area), browse-chaparral (9,000 acres or 23% of total area), and riparian (341 acres or 1% of total area) (USFS 2001a). Upland soils have been noted as highly erosive which has contributed to instability and aggradation due to increased sediment loading of certain channels (USFS 2001a). Soil condition within the Jerome allotment can be summarized as 48.2% satisfactory, 50.9% impaired, and 0.8% unsatisfactory (USFS 2001a).

There are no perennial reaches within the Jerome allotment as the 341 riparian acres are adjacent to ephemeral streams residing within Black, Wilbur, and Gaddis canyons. Consequently, there is no designated critical habitat for either spikedace or loach minnow residing within the Jerome allotment.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Verde Allotment

Four main vegetation types exist within the 21,286 acre Verde allotment. These vegetation types consist of grasslands (6,736 acres or 32% of total area), pinyon-juniper (3,762 acres or 18% of total area), browse/chaparral (4,359 acres or 20% of total area), and riparian (60 acres or 0.2% of total area) (USFS 2001a). No perennial stream reaches reside within the Verde allotment. Therefore, there is no designated critical habitat for either spikedace or loach minnow on the Verde allotment.

Soil conditions for the Verde allotment can be summarized as 44% satisfactory, 48.7% impaired, and 7.3% unsatisfactory (USFS 2001a). Herbaceous ground cover has been reduced as a result of juniper encroachment and off-highway vehicle users are creating many new trails further exacerbating the loss of vegetative ground cover and, ultimately, limiting soil function (USFS 2001a).

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Copper Canyon Allotment

Three main vegetation types exist within the 10.065 acre Copper Canyon allotment. These vegetation types consist of grasslands (3,044 acres or 30% of total area), pinyon-juniper (2,829 acres or 28% of total area), and riparian (180 acres or 2% of total area) (USFS 2001a). The 180 riparian acres within the allotment are adjacent to Copper Creek, an intermittent stream of which 80 acres are fenced for exclusion from livestock. The remaining 100 acres are used as winter pasture. Soil conditions for the Copper Canyon allotment can be summarized as 59.3% satisfactory, 33.4% impaired, and 7.3% unsatisfactory (USFS 2001a). The PNF has noted that

juniper encroachment and roads may have a deleterious effect on stream function within the Copper Canyon allotment (USFS 2001a). While two 5th code watersheds, Gap Creek and Verde, exist within the Copper Canyon allotment, no perennial waterbodies exist within this allotment and subsequently no designated critical habitat for spikedace or loach minnow.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Young Allotment

Three main vegetation types have been described within the 880 acre Young allotment. These vegetation types consist of grassland (467 acres or 53% of total area), pinyon-juniper (220 acres or 25% of total area), and browse-chaparral (154 acres or 18% of total area) (USFS 2001a). There are no perennial reaches of surface water within the Young allotment and, consequently, no riparian vegetation zones or critical habitat for spikedace or loach minnow.

Soil conditions for the Young allotment can be summarized as 13.4% satisfactory, and 86.6% impaired. In 1995, the Salt Fire burned approximately 75% of the young allotment which resulted in total non-use of the allotment from 1995 through 1998.

This allotment has been grazed under the current regime since 1998 and is subject to continued grazing, under a term permit, through 2008.

Squaw Peak Allotment

Four main vegetation types exist within the Squaw Peak allotment. These vegetation types consist of grasslands (680 acres or 5% of total area), pinyon-juniper (2,972 acres or 24% of total area), browse/chaparral (3,745 acres or 30% of total area), and riparian (61 acres or 0.5% of total area) (USFS 2001a). The 61 riparian acres within the allotment are partially adjacent to two miles of the Verde River (excluded from livestock use) as well as two miles of Chasm Creek which is exposed to limited grazing (USFS 2001a). The two river miles of the Verde River are designated as critical habitat for both spikedace and loach minnow. The PNF has indicated that these two miles may potentially be occupied by spikedace. However, no loach minnows are occupying this segment at this time.

Soil conditions for the Squaw Peak allotment can be summarized as 64.7% satisfactory, 34.1% impaired, and 1.2% unsatisfactory (USFS 2001a). The Prescott NF has noted that the allotment appears to be overstocked and exclusion fencing does not appear to be improving the cattle management problems associated with this allotment. Additionally, topography limits the utilization of interior pasture fencing. Consequently, cattle are rotated in terms of elevation which has proven to be an effective management strategy when accompanied by light stocking rates (60 - 80 head) (USFS 2001a).

Verde River: Lower Reach

Brown Spring and Sycamore allotments occur within the lower reach of the Verde River watershed. As noted in the upper and middle reaches of the Verde River, in assessing the overall conditions of the uplands, it is useful to examine soil conditions as soil conditions indicate the sensitivity of the ground surface to precipitation events and their subsequent ability to minimize erosion and transportation of sediment to stream channels. To better assess the conditions of the uplands as a whole, in factoring the conditions observed in each allotment, the average soil condition rating for the upper reach of the Verde River watershed was calculated by the PNF. According to said calculations, watershed conditions in the lower reach of the Verde River were determined to be 55.8% satisfactory, 35.8% unsatisfactory, and 8.4% impaired (figures rounded to the nearest 10th percentile).

Brown Springs Allotment

Four main vegetation types exist within the 16,044 acre Brown Springs allotment. These vegetation types consist of grasslands (2,424 acres or 15% of total area), pinyon-juniper (2,518 acres or 16% of total area), browse/chaparral (3,584 acres or 22% of total area), and riparian (256 acres or 2% of total area).

Three waterbodies, the Verde River, Gap Creek, and Coldwater Creek exist within the allotment boundaries. Specifically, 12 miles of the Verde River, 8 miles of Gap Creek and 4 miles of Coldwater Creek (totaling 24 perennial stream miles) exist within the allotment. Of these perennial stream miles, only the 12 miles of the Verde River are designated critical habitat for spikedace and loach minnow. However, neither spikedace or loach minnow are believed to be occupying the lower reach of the Verde River (USFS 2001a, USFS 2001b). A total of 256 riparian acres are accessible to grazing activity. Between the Verde River, Gap Creek and Coldwater Creek, 10 perennial stream miles are accessible to grazing, or 42% of the total perennial stream miles.

Soil conditions for the Brown Springs allotment can be summarized as 59.8% satisfactory, 39.5% impaired, and 0.7% unsatisfactory.

The PNF has noted that roads are having an adverse affect on stream function within the Brown Springs allotment (USFS 2001a). Overall, the vegetation and soils are moving toward or achieving allotment management objectives (USFS 2001a).

This allotment has been grazed from 1995 and is subject to grazing, under a term permit, through 2005.

Sycamore Allotment

Five distinct vegetation types have been identified within the 32,146 acre Sycamore allotment. These vegetation types consist of grassland (9,230 acres or 29% of total area), pinyon-juniper (7,986 acres or 25% of total area), pine (2,781 acres or 9% of total area), browse/chaparral (7,736

acres or 24% of total area), and riparian (594 acres or 18% of total area) (USFS 2001a). The 594 riparian acres within the allotment are adjacent to the approximate 2 to 3 miles of the intermittent Sycamore Creek.

Soil conditions for the Sycamore allotment can be summarized as 51.8% satisfactory, 32.1% impaired, and 16.1% unsatisfactory (USFS 2001a). Two specific issues of concern for the Prescott NF pertain to tobosa grass and juniper. Specifically, accumulation of standing biomass is inhibiting the vigor of tobosa grass in certain, unidentified areas. In conjunction, juniper invasion has reduced herbaceous ground cover, plant diversity and production whereby threatening the maintenance of the Agua Fria Grasslands habitat (USFS 2001a).

Two 5th code watersheds reside within the Sycamore allotment, the Gap Creek and Agua Fria. Additionally, approximately 2 to 3 intermittent stream miles on Sycamore Creek exist within this allotment. Some of the perennial reaches of Sycamore Creek are excluded from grazing while others are included in pasture rotation (USFS 2001a).

Critical Habitat Considerations

In addition to water quality, parameters such as stream gradient (velocity) and substrate are important factors in spikedace and loach minnow habitat and are specific to the ontology of the fish species themselves.

As acknowledged by the USFS, the relative complexity of the Verde River watershed brings difficulty in assessing potential effects to listed species or critical habitat from various land uses. However, the USFS believes that all but one of the critical habitat constituent elements for spikedace and loach minnow are currently being met in the Verde River system. The one constituent element lacking is the absence of nonnative fish in the system (USFS 2001b). Approximately nine nonnative fish species occur within the Verde River system, within the action area (see tables below). Crayfish (*O. virilis*), another nonnative species present in the Verde River system, also pose a threat to native fish through direct predation.

In assessing the potential for the suitable critical habitat within the Verde River and its tributaries to support viable populations of loach minnow and spikedace, the USFS examined water quality, macroinvertebrate populations (in consideration as a prey base), turbidity (in correlation to erosion rates and watershed conditions), and channel substrate (in consideration of meeting reproductive and foraging requirements). USFS analysis of compiled data indicates the potential limiting factor is the systems buffering capacity against anthropogenic and/or natural pollutants (USFS 2001b).

The assessment of general, physical characteristics of the riparian areas and the stream channels has been accomplished through various techniques employed by USFS personnel. These techniques may include the Prescott Riparian Inventory and Monitoring Methodology (PRIMM), Proper Functioning Condition (PFC), and other field survey techniques. Results from the

implementation of these surveys have varied widely with respect to relative health of the individual riparian ecosystems. Livestock exclusion is occurring where areas have been noted as impaired or dysfunctional and on-going monitoring by the USFS ensures that stray cattle are identified and removed from excluded areas. To date, no ephemeral channels appear to be suffering from incision or other symptoms of accelerated erosion as all ephemeral streams appear to be aggrading, as evidenced by increasing sedimentation (USFS 2001b).

Land uses, and their associated demands on water resources, should be considered when assessing or developing the baseline condition of the natural environment of a given area. In Arizona, hydrologic connectivity between shallow aquifers and perennial (or intermittent) streams is well documented. Groundwater pumping, in excess of natural aquifer recharge potential, will reduce surface flows resulting in changes in stream channel morphology and increasing a stream's vulnerability to the effects of erosion and subsequent sedimentation. These alterations can have significant, detrimental impacts to the associated riparian and aquatic habitat.

Land Uses:

Livestock Grazing

Land uses within the Verde River watershed of the Prescott and Kaibab National Forests include, but may not be limited to, livestock grazing, mining, agriculture, recreation and development. Of these land uses, livestock grazing has been determined by the USFS as the "most pervasive activity on forest land in the analysis area and has had the greatest effect on soil conditions (USFS 2001b). Various data sources indicate persistent problems associated with range condition. For instance, it is believed the most detrimental impacts to range condition occurred during the late 1800's through the early 1900's resulting in severe soil erosion and loss of perennial plant species (USFS 2001b). Encroachment by pinyon/juniper is also a symptom of a deteriorating range condition and can be attributed to the grazing of grasses and forbs, limiting the fine fuels needed to carry fire on specific soil types (USFS 2001b). Compaction and erosion have also been identified by the USFS as effects from livestock grazing on the Verde watershed but USFS analysis of available data has been unable to correlate the expected detrimental effects from the compaction and/or erosion of soils in the uplands to impacts incurred to the critical habitat for the spikedace or loach minnow in the Verde River on the Prescott NF (USFS 2001b). Livestock grazing can also affect riparian areas both directly and indirectly, by degrading bank conditions through trampling and removal of vegetation, increasing soil compaction and thereby decreasing infiltration at the stream and within the uplands, decreasing the ability of the stream system to handle high energy flows by removing essential vegetation, and increasing the instability of the river system. Livestock numbers using the Verde watershed for grazing have declined or remained steady with the most significant reduction in livestock numbers coinciding with the drought which occurred during the 1980's.

Recreation

In addition to livestock grazing, other natural resource uses have had an affect on native habitat and the biota it supports. Recreation, for example, is concentrated in Arizona's waterbodies. Impacts from recreation, most notably primitive roads, on the Verde River included accelerated soil erosion and subsequent sedimentation of the river.

Water Resources and Development

In consideration of current and past land uses, one must consider how these uses correlate with water use within the Verde watershed. In the Verde watershed, the greatest volume of water is used for irrigation purposes (USFS 2001a). However, a shift is occurring that is defined by decreasing irrigation demands and increasing municipal and domestic demands groundwater. Consequently, local governments are looking for additional groundwater sources in neighboring basins, chiefly the Big Chino Basin. Conclusions, based upon a study by Wirt and Hjalmarson (2000) of the U.S. Geological Survey, indicate that at least 80% of the total base flow in the upper Verde River is supplied by the Big Chino aquifer and associated spring, one of two springs known to feed 24 miles of the upper Verde River (USFS 2001a). With a decrease in base flow, a river's ability to buffer contaminant loading (i.e. sediments from soil erosion) is lessened which increases the likelihood for adverse affects to aquatic habitats from what would normally be considered a minimal disturbance.

Development, another resource use in the Verde watershed, has become a considerable threat to perennial streams and their tributaries and it is exacerbated by land exchanges between public and private entities. The Verde Valley has experienced an increase in population of 146% from 1980 through 2000 (USFS 2001b). Increasing populations require increasing water consumption, or increased pumping of regional aquifers for domestic use. Actual amounts of groundwater use by domestic consumers is poorly understood but estimates indicate that approximately 1160 acre-feet per year is pumped in the upper Verde River basin and 1218 acre-feet is pumped from groundwater in the middle Verde River basin for residential household use (USFS 2001b).

Municipal uses of water in the Verde River watershed are also worthy of examination. The majority, approximately 84%, of water supplied for municipal purposes is derived from groundwater sources (USFS 2001b). The remaining water required for municipal purposes is from surface water diversion (5%) or from a combination of surface and groundwater (11%). The Arizona Department of Water Resources has estimated that by the year 2040, municipal groundwater use within the upper and middle Verde River watershed will increase 104% to 29,000 acre-feet per year (USFS 2001b).

In addition to domestic and municipal uses of groundwater within the upper and middle Verde River watershed, industrial or commercial uses account for some of the groundwater use. Commercial and industrial uses of groundwater are essentially limited to golf course irrigation and sand and gravel operation requirements. Seven golf courses and four sand and gravel operations account for all the use considered in this designation at a total volume of almost 6000

acre-feet per year of groundwater used within the upper and middle Verde River watershed (USFS 2001b).

Agriculture

Agricultural uses within the Verde Valley have decreased substantially. Accordingly, there is a theoretical reduction in water demand (USFS 2001a) as agricultural land is converted to other uses. Decreasing agricultural demands for water resources in the Verde Valley may have helped to defray the ecological costs of other water-consumptive land uses within the action area.

Mining

In addition to agricultural uses, mining-related land uses within the Verde watershed have decreased substantially. Copper mines within the watershed ceased operations during the late 1960's. However, sand and gravel operations remain prevalent within the Verde watershed but have been removed from localities within the Verde River floodplain.

Status of the Species and Critical Habitat within the Action Area

Spikedace

Currently, spikedace are potentially occupying the upper Verde River complex from just below the confluence with Granite Creek to just below the confluence with Sycamore Creek, with the highest occupancy occurring in the upper reach above Perkinsville (see Tables 3 and 4) becoming slightly less abundant in the wider floodplain areas near Perkinsville and the Sycamore Creek confluence (USFS 2001b). As supported by survey data (see Tables 3 and 4), spikedace numbers have decreased substantially in the downstream direction, approaching Camp Verde, with historical sightings occurring in 1938 and 1950 (USFS 2001a). The stream miles, in the downstream direction, likely occupied by spikedace are bordered by the Muldoon, Del Rio, China Dam, Sand Flat, Horseshoe, Antelope Hills and Perkinsville allotments in the upper reach of the Verde River complex.

Loach Minnow

Loach minnows, alternatively, are considered extirpated from the entire Verde River system, with the last confirmed observations occurring in 1938 above Camp Verde (USFWS 2001b, Girmendock and Young 1997). In summary, the stream gradient and habitat diversity are within spikedace and loach minnow limits (USFS 2001a).

Critical Habitat

Critical habitat constituent elements were described above in the “Status of the Species/Critical Habitat section of this opinion for both spikedace and loach minnow. The following discussion, however, will describe the how these constituent elements are met within the Verde River

system. This discussion was extracted primarily from the USFS Watershed Condition Assessment for Select Verde River 5th Code Watersheds.

Permanent, Flowing, Unpolluted Water

Approximately 94 miles of critical habitat (Verde River) are within or adjacent to the action area which is comprised by portions of the Granite Creek, Hell Canyon, Sycamore Creek, Verde, and Gap Creek sub-watersheds (USFS 2001a). The first mile of the Verde River, below Sullivan Lake is ephemeral (USFS 2001b). The second river mile includes Stillman Lake, a large pool extending downstream to the confluence with Granite Creek created by an alluvial fan bedload deposited by Granite Creek. Just beyond Stillman Lake, Granite Creek, an intermittent stream, enters the Verde River. The confluence of the Verde River and Granite Creek is dry with surface flow resuming a short distance downstream. Big Chino Springs, located approximately between 2.3 and 4.0 river miles from Sullivan Lake, provides the majority (80%) of the base flow for the upper Verde River. Perennial flow continues past Camp Verde but fluctuates as a result of irrigation diversions.

Turbidity and *Escherichia coli* continue to be the leading stressors of water quality within the upper and middle Verde with 8.6% of turbidity samples and 4.2% of *Escherichia coli* samples, collected from 1996 - 2000, exceeding standards. However, the water quality of the Verde River is currently meeting every designated use classification for water quality as defined by the Arizona Department of Environmental Quality (ADEQ 2000). An assessment of the aquatic macroinvertebrate community was also performed by ADEQ. An index, referred to as the Index of Biological Integrity (IBI), was used as an assessment protocol for a warm-water aquatic community. The Verde River scores ranged from "good to "exceptional using the IBI with the exception of one reach from Granite Creek to Hell Canyon which has assessed as "fair , indicating potential water quality impairment (USFS 2001b). Reasons for this potential impairment vary but are believed to include historic livestock grazing impacts, sand and gravel operations and/or recreational uses.

Living areas to Support the Life History of Spikedace and Loach Minnow

Living areas preferred by adult spikedace are characterized by slow to swift flow velocities in shallow water with shear zones where rapid flow borders slower flow, areas of sheet flow at the upper ends of mid-channel sand and gravel bars, and eddies at downstream riffle edges. Living areas preferred by juvenile spikedace are characterized by slow to moderate flow velocities in shallow water with moderate amounts of instream cover. Living areas preferred by larval spikedace are characterized by slow to moderate flow velocities in shallow water with abundant instream cover. Spikedace habitat use in the upper Verde River consists of aquatic areas characterized by glide, run, and low-gradient riffle macrohabitats were described by Rinne and Stefferud (1996) and Neary *et*

al. (1996) and summarized by the PNF (USFS 2001b). Glide macrohabitats within the upper Verde River consist of a gradient of less than 0.3%, an average depth of 55 cm (21.67 inches) [range 25-43 cm (9.85-16.94 inches)], an average velocity of 22 cm/sec (8.67 in/sec) [range 15-26 cm/sec (5.91-10.24 in/sec)], with sand/gravel as the main substrate (USFS 2001b). Run macrohabitats within the upper Verde River consist of a gradient between 0.3 - 0.5%, an average depth of 42 cm (16.55 inches) [range 20-80 cm (7.88-31.52 inches)], an average velocity of 24 cm/sec (18.91 in/sec) [range 20-80 cm/sec (7.88-31.52 in/sec)], with sand/gravel as the main substrate (USFS 2001b). Finally, low-gradient riffle macrohabitats within the upper Verde River consist of a gradient of less than 0.5 - 1.0%, an average depth of 25 cm (9.85 inches) [range 10-41 cm (3.94-16.15 inches)], an average velocity of 59 cm/sec (23.25 inches/sec) [range 30-80 cm/sec (11.82-31.52 inches^3/sec)], with gravel/pebble as the main substrate (USFS 2001b).

Since loach minnow are considered extirpated from the Verde River system, the condition or presence of the constituent elements for loach minnow have been examined less intensively than for spikedace. Adequate living areas for adult and juvenile loach minnows are characterized by moderate to swift flow velocities in shallow water with gravel, cobble, and rubble substrates. Preferred living areas for larval loach minnows, however, are characterized by slow to moderate flow velocities in shallow water with sand, gravel, and cobble substrates and abundant instream cover. Finally, spawning areas preferred by loach minnow are characterized by slow to swift flow velocities in shallow water with uncemented cobble and rubble substrate (USFWS 2000). Stream gradient, habitat diversity, and channel gradient are meeting loach minnow requirements, according to Rinne and Stefferud (1996) and Neary *et al.* as summarized by the PNF (USFS 2001b).

Substrate, Sediments, and Embeddedness

Substrate condition and embeddedness are important when considering the quality of habitat for spikedace and loach minnow foraging and reproduction. Spikedace and loach minnow require sand, gravel and cobble substrates with low to moderate amounts of fine sediment and substrate embeddedness (USFWS 1994a, USFWS 1994b). The PNF analysis used Rosgen (1996) stream channel type classifications for evaluation of substrate composition on three reaches of the Verde River within the PNF. Fine sediments, the particle size of most concern regarding sedimentation, are described by Rosgen (1996) as silt/clay substrates less than 0.062 mm (0.0024 inches) in diameter. Embeddedness is defined by conditions where substrate such as gravel, cobble, or boulders are 50% surrounded by fine sediment.

In the upper reach of the Verde River, from Sullivan Lake to Tapco (Reach I), a total of 116 stations were sampled for substrate composition. This reach is bordered by the Muldoon, Del Rio, China Dam, Sand Flat, Perkinsville, Horseshoe, and Antelope Hills allotments. The substrate composition from Sullivan Dam to Granite Creek varied at each station with the first river mile composed mostly of boulder, bedrock, and silt/clay

and the Stillman Lake section being dominated by silt/clay, as expected for such slow moving water (USFS 2001b). The second section, from Granite Creek to Hell Canyon, within this reach contained 86 sampling stations. Seventy-six stations had sand or gravel substrate, five stations were mostly cobble, and the remaining five stations were predominantly silt/clay (USFS 2001b). The substrate composition from Hell Canyon to Sycamore Creek was measured at seventeen stations. Nine of the 17 stations had substrate mostly composed of sand or gravel, one station had mostly cobble substrate, and the remaining seven stations had substrate comprised of silt/clay (USFS 2001b). Four stations were sampled from Sycamore Creek to Tapco and all had substrate dominated by sand or gravel. All in all, within Reach I, a relatively low 13.8% of all substrate sample stations were classified as silt/clay which indicates an abundance of suitable spawning habitat for spikedace and loach minnow.

Substrate assessments were not performed within Reach II between Tapco and Camp Verde due to private property access restrictions. However, five stations were used to assess substrate composition in Reach III from Camp Verde to the southern boundary of the PNF. Three of the five were dominated by gravel, one by sand, and one station by bedrock (USFS 2001b).

Pool, Riffle, Run, and Backwater Habitats

The PNF summarized habitat descriptions for the Verde River which were extracted from various sources (Hendrickson 1993, Sullivan and Richardson 1993, Rinne and Stefferud 1998). Both spikedace and loach minnow require pool, riffle, run, and backwater habitats (USFWS 1994a, USFWS 1994b). The reach of the Verde River between the confluence with Granite Creek to the Verde Ranch is comprised mostly of riffles and shallow runs, with an occasional shallow pool. Downstream of the Verde Ranch, the river enters a narrow and steep canyon which allows for the formation of several pools, many deep and boulder-filled. Interspaced between these pools are runs, rapids, and higher-gradient riffles (USFS 2001b). PNF surveys performed in 1996 had delineated approximately 41% glides, 31% runs, 19% riffles, and 9% pools from the Verde Ranch to Duff Spring and 23% glides, 37% runs, 28% riffles, and 12% pools from Duff Spring to Hell Canyon (USFS 2001b). Below Perkinsville, the Verde River is characterized by many pools, separated by shallower, rocky riffles and rapids (USFS 2001b). Below Sycamore Creek, the Verde River again re-enters a steep-walled canyon, limiting the backwater habitat but providing for pools, rapids and runs (USFS 2001b). All reaches discussed immediately above have been designated as critical habitat for spikedace and loach minnow.

Farther downstream, through the Verde Valley (the middle segment of the Verde River within the action area), the Verde River winds through predominantly privately owned land. The river within this segment experiences significant diversions and other effects from human activities which greatly influence the condition of native fish habitat (USFS 2001b). However, past the confluence with West Clear Creek to approximately Sycamore Canyon (the lower segment of the Verde River within the action area), the

Verde River returns to a more natural flow regime and can be characterized as generally shallow with 59% pools, 35% run, and 5% riffle habitat types (USFS 2001b, Hunt et al.1992).

Low Stream Gradient

Spikedace require low stream gradients and loach minnow require low to moderate stream gradients (USFWS 1994a, USFWS 1994b). The PNF has classified the stream channel types of the Verde from Sullivan Dam to the southern PNF boundary as C and F. These channel type designations reflect a stream gradient of less than 2% (USFS 2001b). The PNF has indicated that approximately 80% of the spikedace occupied critical habitat in the upper Verde River is less than 0.5% gradient (USFS 2001b).

Water Temperatures/Seasonal Variation

Both spikedace and loach minnow require water temperatures in the approximate range of 1-30°C (35-85°F) with natural diurnal and seasonal variation (USFWS 1994a, USFWS 1994b). Water temperatures were measured, year-round from 1989-1991, by the PNF at four locations along the Verde River (Paulden, Clarkdale, Verde Ranch and Perkinsville) and within spikedace occupied critical habitat (USFS 2001b). Temperatures ranged from 5- 28°C (41-82°F) and varied seasonally (USFS 2001b). This range is acceptable for spikedace and loach minnow but, at the upper extremes, offers little buffer to fluctuations in riparian shading.

Macroinvertebrates

The presence of a hearty food base is an important characteristic of a habitat capable of supporting native fish populations. Macroinvertebrates, or aquatic insects, are eaten by many native fish species including spikedace and loach minnow and may even serve as indicators of aquatic habitat quality in general. Monitoring of macroinvertebrate communities has been performed by ADEQ for the Verde River. Scores generated from these activities are largely based on species richness (diversity in taxa) and relative abundance of preferred species (USFS 2001b). The reach of the Verde River from Granite Creek to Hell Canyon rated as “fair , from Hell Canyon to Perkinsville rated as “exceptional , and all other downstream reaches rated as “good (USFS 2001b).

Natural Flood Regimes and the Unregulated Hydrograph

The Verde River segment designated as critical habitat for spikedace and loach minnow within the action area is largely unregulated. PNF records indicate the Verde River experiences elevated flows approximately every 7-10 years (USFS 2001b). The latest significant flood events occurred during 1993 and 1995 and had a pronounced effect on the riparian community and aquatic habitat. The middle reaches of the Verde River, as it flows through the Verde Valley, is heavily used for water withdrawal or flood control projects and by private interests and does not experience a natural hydrograph.

Presence of Nonnative Fish Species

As noted by PNF staff, the upper Verde River is believed to currently possess all the critical habitat constituent elements except for one, the absence of nonnative fish species. In designating critical habitat for spikedace and loach minnow, the Service noted that the presence of nonnative fish species was one of two primary elements in the decline of both spikedace and loach minnow, the other being habitat destruction (or modification) (USFWS 2000). The presence of nonnative fish species is detrimental to native fish for several reasons, some of which include competition for resources, direct predation, and introduction of parasites and/or disease.

Information of fish species composition is available from data generated by the collaborative effort from the PNF and the AGFD. Specifically, seven fish survey stations were located on the Verde River from 1994 - 2000. The first station, "Burnt Ranch , is located approximately 1 mile upstream from the PNF boundary, and downstream of the confluence with Granite Creek on property managed by the AGFD. This station is not directly influenced, in terms of upland watershed condition, by any of the allotments considered under this consultation. The second station, "FR638", is approximately 2 stream miles downstream from Burnt Ranch and is predominantly influenced by the upland watershed conditions occurring on the Muldoon allotment. The third station, "Duff Spring , is approximately 8 stream miles downstream of the FR638 station and is predominantly influenced by the upland watershed conditions occurring on the Del Rio and China Dam allotments. The fourth survey station, the "Bear Siding station, is located approximately 5 stream miles downstream from the Duff Spring station and is predominantly influenced by upland watershed conditions which occur on the Sand Flat, China Dam, Del Rio, and West Bear allotments. The fifth survey station, the "Perkinsville station, is approximately 4 stream miles downstream from the Bear Siding station and is predominantly influenced by watershed conditions occurring on the Perkinsville, China Dam and Sand Flat allotments. The sixth survey station, the "Railroad Bridge (later renamed as "Black Bridge) is located approximately 2.5 stream miles downstream of the Perkinsville station and is predominantly influenced upland watershed conditions occurring on the Perkinsville and Horseshoe allotments. The last survey station, the "Sycamore station, is located approximately 8 stream miles downstream of the Railroad Bridge (or Black Bridge) station and is predominantly influenced by upland watershed conditions occurring on the Perkinsville allotment. It should be noted that although survey stations are noted as being "predominantly influenced by upland watershed conditions on particular allotments, the effects of upland watershed conditions are synergistic in nature and may be generally observed several miles downstream. Therefore, it is reasonable to assume that the survey stations located progressively downstream are indirectly influenced by upland watershed conditions occurring on allotments farther upstream as well as those allotments at close proximity to the survey station under consideration.

The following table summarizes nonnative (and native) fish surveys taken from 1994 - 2000 in the critical habitat of the upper Verde River from one stream mile upstream from the PNF boundary to the confluence with Sycamore Creek, within the action area.

Table 1. Nonnative fish counts in upper Verde River from one stream mile upstream from the PNF boundary to the confluence with Sycamore Creek from 1994 through 2000 (USFS 2001b). "NA indicates that data was not available.

Species	Burnt Ranch	At Forest Road 638	Duff Spring	Bear Siding	Perkinsville	Black Bridge	Sycamore
Yellow Bullhead (*Ameiurus natalis*)	1994 - 2 1995 - 2 1996 - 1 1997 - 13 1998 - 0 1999 - 1 2000 - 4	1994 - 3 1995 - 3 1996 - 0 1997 - 10 1998 - 0 1999 - 3 2000 - 7	1994 - 1 1995 - 17 1996 - 1 1997 - 0 1998 - 9 1999 - 4 2000 - 3	1994 - 1 1995 - 5 1996 - 3 1997 - 0 1998 - 4 1999 - 0 2000 - 1	1994 - 12 1995 - 1 1996 - 4 1997 - 1 1998 - 5 1999 - 1 2000 - 1	1994 - 2 1995 - 0 1996 - 0 1997 - 0 1998 - 8 1999 - 5 2000 - 1	1994 - 10 1995 - 1 1996 - 0 1997 - 16 1998 - 7 1999 - 1 2000 - 5
Carp (*Cyprinus carpio*)	1994 - 1 1995 - 0 1996 - 1 1997 - 3 1998 - 1 1999 - 0 2000 - 3	1994 - 0 1995 - 0 1996 - 5 1997 - 1 1998 - 1 1999 - 2 2000 - 0	1994 - 3 1995 - 0 1996 - 5 1997 - 12 1998 - 2 1999 - 0 2000 - 1	1994 - 4 1995 - 0 1996 - 1 1997 - 0 1998 - 4 1999 - 0 2000 - 1	1994 - 11 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 1 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 1 2000 - 0	1994 - 4 1995 - 0 1996 - 1 1997 - 3 1998 - 1 1999 - 0 2000 - 10
Red Shiner (*Cyprinella lutrensis*)	1994 - 39 1995 - 7 1996 - 88 1997 - 1 1998 - 27 1999 - 1 2000 - 89	1994 - 61 1995 - 8 1996 - 112 1997 - 82 1998 - 101 1999 - 33 2000 - 437	1994 - 32 1995 - 55 1996 - 1 1997 - 830 1998 - 79 1999 - 23 2000 - 100	1994 - 227 1995 - 10 1996 - 27 1997 - 9 1998 - 6 1999 - 203 2000 - 238	1994 - 1109 1995 - 4 1996 - 38 1997 - 1222 1998 - 701 1999 - 7 2000 - 421	1994 - 2 1995 - 8 1996 - 2 1997 - 77 1998 - 132 1999 - 261 2000 - 260	1994 - 3 1995 - 5 1996 - 9 1997 - 17 1998 - 1 1999 - 17 2000 - 49
Channel Catfish (*Ictalurus punctatus*)	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 2 1996 - 0 1997 - 1 1998 - 0 1999 - 0 2000 - 0	1994 - 1 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 4 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Mosquitofish (*Gambusia affinis*)	1994 - NA 1995 - NA 1996 - NA 1997 - 3 1998 - 5 1999 - 68 2000 - 226	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 1 1999 - 1 2000 - 1	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - 0 1998 - 0 1999 - 0 2000 - 0

Species	Burnt Ranch	At Forest Road 638	Duff Spring	Bear Siding	Perkinsville	Black Bridge	Sycamore
Flathead Catfish (*Pylodictis olivaris*)	1994 - NA 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - 2 1996 - 0 1997 - 0 1998 - 1 1999 - 0 2000 - 0	1994 - NA 1995 - 0 1996 - 0 1997 - 1 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - 0 1996 - 1 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - NA 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Green Sunfish (*Lepomis cyanellus*)	1994 - 0 1995 - 0 1996 - 1 1997 - 4 1998 - 9 1999 - 39 2000 - 31	1994 - 0 1995 - 8 1996 - 1 1997 - 0 1998 - 1 1999 - 0 2000 - 3	1994 - 0 1995 - 5 1996 - 0 1997 - 0 1998 - 2 1999 - 0 2000 - 8	1994 - 0 1995 - 10 1996 - 2 1997 - 3 1998 - 6 1999 - 7 2000 - 52	1994 - 4 1995 - 3 1996 - 0 1997 - 1 1998 - 1 1999 - 2 2000 - 1	1994 - 0 1995 - 1 1996 - 2 1997 - 0 1998 - 2 1999 - 1 2000 - 0	1994 - 0 1995 - 2 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Smallmouth Bass (*Micropterus dolomieu*)	1994 - 2 1995 - 3 1996 - 5 1997 - 8 1998 - 11 1999 - 6 2000 - 18	1994 - 0 1995 - 1 1996 - 0 1997 - 1 1998 - 5 1999 - 5 2000 - 10	1994 - 4 1995 - 6 1996 - 12 1997 - 6 1998 - 19 1999 - 18 2000 - 9	1994 - 3 1995 - 0 1996 - 10 1997 - 11 1998 - 4 1999 - 15 2000 - 2	1994 - 2 1995 - 0 1996 - 1 1997 - 1 1998 - 3 1999 - 13 2000 - 2	1994 - 0 1995 - 0 1996 - 4 1997 - 2 1998 - 17 1999 - 11 2000 - 3	1994 - 3 1995 - 0 1996 - 0 1997 - 6 1998 - 5 1999 - 36 2000 - 4
Largemouth Bass (*Micropterus salmoides*)	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 0	1994 - NA 1995 - NA 1996 - NA 1997 - NA 1998 - NA 1999 - 0 2000 - 1
Fathead Minnow (*Pimephales promelas*)	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 7 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0

The yearly totals of nonnative fish species in the upper Verde River are provided for assessment of annual trend analysis of population fluctuations. These fluctuations may provide insight on the impacts to native fish populations, mainly spikedace, over time. The yearly totals for nonnative fish species between 1994 and 2000 are provided below.

Table 2. Yearly total nonnative fish counts in the upper Verde River from one stream mile upstream from the PNF boundary to the confluence with Sycamore Creek from 1994 - 2000 (USFS 2001b).

Species	1994	1995	1996	1997	1998	1999	2000
Yellow Bullhead (*Ameiurus natalis*)	31	29	9	40	33	15	22
Carp (*Cyprinus carpio*)	23	6	13	19	9	4	15
Red Shiner (*Cyprinella lutrensis*)	1473	97	275	2238	1047	545	1594
Channel Catfish (*Ictalurus punctatus*)	5	2	0	1	0	0	0
Mosquitofish (*Gambusia affinis*)	NA	NA	NA	3	6	59	227
Flathead Catfish (*Pylodictis olivaris*)	NA	1	1	1	1	0	0
Green Sunfish (*Lepomis cyanellus*)	4	29	6	8	21	49	95
Smallmouth Bass (*Micropterus dolomieu*)	14	10	32	35	64	104	48
Largemouth Bass (*Micropterus salmoides*)	NA	NA	NA	NA	NA	0	1
Fathead Minnow (*Pimephales promelas*)	7	0	0	0	0	0	0

The PNF has conducted native fish surveys in the upper Verde River at five locations from 1994 through 2000. It is useful to fully understand the population dynamics of other native fish species, absent from consideration under this consultation, to assess the interrelationship between spikedace and other native species occupying similar habitat and the potential effects of various land usage within the watershed where they occur.

Table 3. Native fish counts in upper Verde River from one stream mile upstream from the PNF boundary to the confluence with Sycamore Creek from 1994 through 2000 (USFS 2001b). Please note: the AGFD reported the observation of a single spikedace at Burnt Ranch in 1999 (M. Leonard, USFS, pers. comm. 2002).

Site	Longfin Dace (*Agosia chrysogaster*)	Desert Sucker (*Catostomus clarki*)	Sonora Sucker (*Catostomus insignis*)	Roundtail Chub (*Gila robusta*)	Spikedace (*Meda fulgida*)	Speckled Dace (*Rhinichthys osculus*)
Burnt Ranch	1994 - 1072 1995 - 0 1996 - 91 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 339 1995 - 15 1996 - 78 1997 - 66 1998 - 21 1999 - 13 2000 - 23	1994 - 278 1995 - 60 1996 - 92 1997 - 68 1998 - 43 1999 - 19 2000 - 124	1994 - 15 1995 - 3 1996 - 23 1997 - 24 1998 - 12 1999 - 3 2000 - 6	**1994 - 257** **1995 - 33** **1996 - 33** **1997 - 0** **1998 - 0** **1999 - 1** **2000 - 0**	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0
At Forest Road 638	1994 - 227 1995 - 11 1996 - 179 1997 - 19 1998 - 12 1999 - 0 2000 - 0	1994 - 230 1995 - 48 1996 - 127 1997 - 76 1998 - 28 1999 - 20 2000 - 74	1994 - 154 1995 - 57 1996 - 307 1997 - 57 1998 - 27 1999 - 4 2000 - 27	1994 - 18 1995 - 4 1996 - 81 1997 - 8 1998 - 19 1999 - 3 2000 - 0	**1994 - 2** **1995 - 2** **1996 - 53** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 0 1995 - 0 1996 - 1 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Duff Spring	1994 - 0 1995 - 0 1996 - 6 1997 - 2 1998 - 0 1999 - 0 2000 - 0	1994 - 192 1995 - 89 1996 - 32 1997 - 0 1998 - 10 1999 - 15 2000 - 2	1994 - 329 1995 - 73 1996 - 51 1997 - 11 1998 - 16 1999 - 17 2000 - 3	1994 - 28 1995 - 50 1996 - 17 1997 - 5 1998 - 23 1999 - 5 2000 - 7	**1994 - 1** **1995 - 0** **1996 - 0** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Bear Siding	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0	1994 - 382 1995 - 45 1996 - 50 1997 - 18 1998 - 15 1999 - 5 2000 - 1	1994 - 357 1995 - 47 1996 - 25 1997 - 4 1998 - 9 1999 - 2 2000 - 3	1994 - 249 1995 - 22 1996 - 6 1997 - 0 1998 - 1 1999 - 0 2000 - 3	**1994 - 1** **1995 - 0** **1996 - 0** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 3 1995 - 0 1996 - 1 1997 - 0 1998 - 0 1999 - 0 2000 - 0
Perkinsville	1994 - 19 1995 - 1 1996 - 5 1997 - 0 1998 - 0 1999 - 0 2000 - 1	1994 - 885 1995 - 90 1996 - 112 1997 - 15 1998 - 35 1999 - 34 2000 - 30	1994 - 442 1995 - 10 1996 - 76 1997 - 28 1998 - 10 1999 - 38 2000 - 11	1994 - 244 1995 - 115 1996 - 57 1997 - 0 1998 - 5 1999 - 13 2000 - 0	**1994 - 37** **1995 - 1** **1996 - 0** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 61 1995 - 23 1996 - 63 1997 - 1 1998 - 12 1999 - 0 2000 - 7

Site	Longfin Dace (*Agosia chrysogaster*)	Desert Sucker (*Catostomus clarki*)	Sonora Sucker (*Catostomus insignis*)	Roundtail Chub (*Gila robusta*)	Spikedace (*Meda fulgida*)	Speckled Dace (*Rhinichthys osculus*)
Black Bridge	1994 - 0 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 2 2000 - 0	1994 - 237 1995 - 36 1996 - 33 1997 - 44 1998 - 13 1999 - 69 2000 - 1	1994 - 27 1995 - 38 1996 - 62 1997 - 34 1998 - 11 1999 - 37 2000 - 4	1994 - 57 1995 - 43 1996 - 50 1997 - 13 1998 - 4 1999 - 0 2000 - 4	**1994 - 38** **1995 - 19** **1996 - 3** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 88 1995 - 2 1996 - 3 1997 - 0 1998 - 0 1999 - 2 2000 - 0
Sycamore	1994 - 1 1995 - 0 1996 - 1 1997 - 0 1998 - 1 1999 - 0 2000 - 0	1994 - 379 1995 - 29 1996 - 38 1997 - 12 1998 - 4 1999 - 11 2000 - 6	1994 - 223 1995 - 37 1996 - 41 1997 - 38 1998 - 8 1999 - 1 2000 - 25	1994 - 165 1995 - 104 1996 - 25 1997 - 0 1998 - 0 1999 - 1 2000 - 0	**1994 - 92** **1995 - 17** **1996 - 51** **1997 - 0** **1998 - 0** **1999 - 0** **2000 - 0**	1994 - 19 1995 - 0 1996 - 0 1997 - 0 1998 - 0 1999 - 0 2000 - 0

The yearly totals of native fish species in the upper Verde River are provided for assessment of annual trend analysis of population fluctuations. The yearly totals for native fish species between 1994 and 2000 are provided below.

Table 4. Yearly total native fish counts in the upper Verde River from one stream mile upstream from the PNF boundary to the confluence with Sycamore Creek from 1994 - 2000 (USFS 2001b). Please note: the AGFD reported the observation of a single spikedace at Burnt Ranch in 1999 (M. Leonard, USFS, pers. comm. 2002).

Year	Longfin Dace (*Agosia chrysogaster*)	Desert Sucker (*Catostomus clarki*)	Sonora Sucker (*Catostomus insignis*)	Roundtail Chub (*Gila robusta*)	Spikedace (*Meda fulgida*)	Speckled Dace (*Rhinichthys osculus*)
1994	1319	2644	1810	778	**428**	171
1995	12	352	322	341	**72**	25
1996	282	471	654	259	**140**	88
1997	21	231	240	50	**0**	1
1998	13	126	124	64	**0**	12
1999	2	167	118	25	**1**	2
2000	1	137	197	20	**0**	7

Consultation History Revisited

In 1998, the existing grazing management strategy underwent formal regional programmatic consultation for on-going grazing on all allotments (Biological Opinion reference #000089RO) with the exception of the Limestone, Tule, and Sycamore allotments. Affect determinations for

spikedace and loach minnow were "may affect, not likely to adversely affect. The following year, term grazing was formally consulted upon for listed species, including spikedace and loach minnow, on all allotments (Biological Opinion reference #2-22-99-F-016) with the same determinations.

Since 1985, over eighty formal consultations have been completed on spikedace and loach minnow in Arizona's perennial waterbodies. These consultations addressed a wide variety of project types including road and bridge construction, water development, timber, prescribed fire, flood repair and control, recreation, stocking of animals, grazing, pollution control, and realty.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, that will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Effects of Grazing on Listed Fishes and Their Critical Habitat

Analysis of the effects of livestock grazing on fish and fish habitat requires examination of subtle, long-term, incremental changes in watershed functions, riparian and aquatic communities, and stream channel morphology. Limited data available on range condition, fish, and fish habitat make an empirical analysis of the effects of grazing and grazing management difficult and often misleading, particularly on an allotment-by-allotment basis. However, extrapolations of general hydrologic and biologic principles and site-specific research data provide a large body of evidence linking degradation of watersheds, stream channels, aquatic and riparian communities, and fish habitat and populations in western North America to grazing and grazing management (Leopold 1924; Leopold 1951; York and Dick-Peddie 1969; Hastings and Turner 1980; Dobyns 1981; Kauffman and Krueger 1984; Skovlin 1984; Kinch 1989; Chaney *et al.* 1990; Platts 1990; Armour *et al.* 1991; Bahre 1991; Meehan 1991; Fleischner 1994).

It is doubtful that any grazing scheme will improve a local hydrologic circumstance over that found under ungrazed conditions (Platts 1990, Belsky *et al*. 1999). Platts (1990) indicates that the two primary reasons why grazing strategies of any type have not protected riverine-riparian systems in the past is because streamside areas are generally incorporated into the larger pastures and not identified as distinct areas needing specialized management, and because the range is generally overstocked. Additionally, riparian systems are vulnerable to deterioration due to condition of the uplands within the watershed and their ability to properly manage heavy precipitation events over short periods, characteristic of the arid southwest. Others, including Borman et al. (1999), have found grazing to be compatible in riparian areas with improving conditions provided the grazing prescription is site and situation specific, and strictly adhered to.

The effects of livestock grazing on native fish survival and recovery, as well as on their critical habitat, from the proposed ongoing livestock grazing and its management would occur through four mechanisms: 1) watershed alteration; 2) physical alteration of streambanks, stream channels, water column, and the riparian vegetation community; 3) alteration of the faunal and floral community; and 4) effects of grazing-related structural elements. These mechanisms have varying effects on spikedace, loach minnow, and their critical habitat.

1) Alteration of the Uplands

Unsatisfactory soil conditions due to past heavy livestock grazing, roads, and other human uses, contribute to changes in overland flows and sediment transport to the river. Soil compaction, changes to root structures in overused plants, changes in plant species composition and overall biomass, and loss of soil from erosion can result from overuse by livestock. In some cases, restoration of the historical condition may not be possible.

Alterations in upland conditions due to grazing are difficult to document due to their long-term, incremental nature; the time lag and geographic distance between cause and effect; and the numerous confounding variables. Despite this, the relationship between livestock grazing in a watershed and effects to river systems is widely recognized and documented (Leopold 1946; Blackburn 1984; Skovlin 1984; Chaney *et al.* 1990; Platts 1990; Bahre 1991; Meehan 1991; Fleischner 1994; Myers and Swanson 1995). Sayre (2001) notes that the emphasis in livestock grazing should be on "managing for the whole , and that "What gets eaten by livestock is a function of numerous processes involving water, soils, decomposers, other plants, and so on. Similarly, Naiman (1992) also notes the connectivity of the watershed with riverine and riparian conditions, indicating that precipitation received in the uplands flows down through the watershed, "...integrating influences of natural and human disturbances within the catchment . Although alterations in upland conditions vary depending upon the number and type of livestock, the length and season of use, and the type of grazing management, the mechanisms remain the same and the effects vary only in extent of area and severity (Blackburn 1984; Johnson 1992).

Livestock grazing may alter the vegetative composition of the uplands (Martin 1975; Savory 1988; Vallentine 1990; Popolizio *et al.* 1994). The PNF has noted (USFS 2001a), in several allotments, a perpetual encroachment of juniper, impeding the native perennial grass species' ability for continued existence and establishment. Alterations in vegetative composition may promote soil compaction and erosion, alter soil chemistry, and cause loss of cryptobiotic soil crusts (Harper and Marble 1988; Marrs *et al.* 1989; Orodho *et al.* 1990; Schlesinger *et al.* 1990; Bahre 1991). Cumulatively, these alterations contribute to increased erosion and sediment input into streams (Johnson 1992; Weltz and Wood 1994). They also contribute to changes in infiltration and runoff patterns, thus increasing the volume of flood flows while decreasing their duration, and decreasing the volume of low flows while increasing their duration (Brown *et al.* 1974; Gifford and Hawkins 1978; Johnson 1992). Groundwater levels may decline and surface flows may decrease or cease (Chaney *et al.* 1990; Elmore 1992). Development of livestock waters may alter surface flows by impoundment, spring capture, or runoff capture.

With the information available, it is difficult to differentiate watershed alteration effects caused by current livestock grazing on the allotments under consultation from those caused by past grazing, current grazing on upslope allotments, agriculture, roads, or other watershed effects. Information presented by the Forest Service for this consultation indicates that the soil conditions in many of the allotments have significant areas in unsatisfactory or impaired condition. We recognize the limitations in the applicability of these soil condition data, but directly applicable data were not available.

The generally degraded soil conditions described in the Forest Service's biological evaluation and associated documentation demonstrates that a combination of historic and current grazing practices have resulted in the chronic deterioration of soil conditions, which may indirectly undermine the ability of the designated critical habitat within, adjacent to, and downstream of the allotments to assist in the recovery of the spikedace and loach minnow.

Allotment management schemes are designed to mitigate potential adverse soil and range effects from grazing activity while simultaneously providing for the physical needs of livestock. The measurable criterion often used for the assessment of implementation success and management is based on percent utilization of certain species or vegetative communities, often in key areas. However, Galt *et al*. (2000) noted that "Consistently, actual measured (percent utilization) use has been 10 - 15% higher than the intended use. We attribute this to livestock trampling, wildlife consumption, and weathering. Overutilization is expected to result in continuation of impaired watersheds.

2) Physical Alteration of Streambanks, Stream Channels, Water Column, Riparian Vegetation, and Aquatic Habitat

The effects of livestock grazing on riparian and aquatic habitats have been well documented and discussed in recent years (Platts 1990, Fleischner 1994, Belsky *et al*. 1999). Potential effects can be categorized into upland/watershed effects, streambank effects, streamflow and channel effects, water column effects, effects to riparian vegetation, and effects to aquatic habitat.

Uplands/Watershed

Changes in the upland or watershed can include removal of vegetation, alteration of species composition of vegetation communities, decreased soil stability and porosity, decreased water infiltration, and increased soil erosion and compaction. Grazing can reduce the roughness coefficient of watersheds, which in turn results in more surface runoff, soil erosion, and flooding, which have effects on the water column, as discussed below. Resulting changes to watercourses can include changes in the hydrograph such as decreased base flows, increased flood flows, and increased sediment (Gifford and Hawkins 1978, Kauffman and Krueger 1984, Chaney *et al*. 1990, Platts 1990, Fleischner 1994).

Streambanks

Cattle will occur in limited areas of streambanks within four of the allotments (West Bear/Del Rio, Perkinsville, Brown Springs, and Sycamore). The potential effects of grazing on streambanks include the chiseling, compaction, collapse, shearing or sloughing of streambank soils by either hoof or head action; elimination of streambank vegetation; erosion of streambanks following exposure to water, ice, or wind due to loss of vegetative cover; and an increased streambank angle which increases water width and decreases stream depth (Platts and Nelson 1985b, Platts 1990, Meehan 1991).

This has been documented to cause progressive adjustments in other variables of hydraulic geometry and results in changes to the configuration of pools, runs, riffles, and backwaters; levels of fine sediments and embeddedness; availability of instream cover; and other fish habitat factors (Bovee 1982, Rosgen 1994). It also changes the way in which flood flows interact with the stream channel and may exacerbate flood damage to banks, channel bottoms, and riparian vegetation. These impacts occur at all levels of cattle presence, but increase as number of livestock and time the cattle are present increase (Marlow and Pogacnik 1985). Cattle presence on streambanks retards rehabilitation for previous damage as well as causing additional alteration (Platts and Nelson 1985a).

Damage can begin to occur almost immediately upon entry of the cattle onto the streambanks, and use of riparian zones may be highest immediately following entry of cattle into a pasture (Platts and Nelson 1985; Goodman *et al*. 1989). Vegetation and streambank recovery from long rest periods may be lost within a short period following grazing reentry (Duff 1979). Bank configuration, soil type, and soil moisture content influence the amount of damage, with moist soil being more vulnerable (Marlow and Pogacnik 1985; Platts 1990).

Streamflow and Channels

Following streambank alteration, potential effects from livestock grazing to the channel itself can include changes in channel morphology and altered sediment transport processes (Platts 1990). Within the stream itself, there can be changes to pools, riffles, runs, and the distribution of backwater areas, a reduction in cover for fishes, elevated water temperatures, changes in nutrient levels, and increased sedimentation (Platts 1990; Belsky *et al*. 1999).

Water Column

Changes to the water column within the stream can be many and varied. Water-column alterations can be caused by changes in the magnitude and timing of organic and inorganic energy inputs to the stream; increases in fecal contamination; changes in water temperatures due to removal of vegetation; changes in water column morphology, including increases in stream width and decreases in stream depth, as well as reduction of stream shore water depth; changes in timing and magnitude of streamflow events from changes in watershed vegetative cover; and increases in stream temperature (Platts 1990; Fleischner 1994).

Riparian Vegetation

The effects of grazing in the uplands on riparian systems have been discussed above. To generate and maintain riparian habitat, a healthy watershed (uplands, tributaries, ranges, etc.) is a key component (Elmore and Kauffman 1994; Briggs 1996). Elmore and Kauffman (1994) note that "simply excluding the riparian area (from grazing) does not address the needs of upland vegetation or the overall condition of the watershed. Unless a landscape-level approach is taken, important ecological linkages between the uplands and aquatic systems can not be restored and riparian recovery will be limited. Continuing to graze in uplands where the soil conditions and riparian habitat in upland tributaries are unsatisfactory will continue to impact spikedace and loach minnow habitat, and result in unnatural flooding, delaying recovery of these species' populations.

Effects of grazing in the riparian areas have been summarized by many authors including Szaro and Pase 1983; Warren and Anderson 1987; Platts 1990; Schulz and Leininger 1990; Schulz and Leininger 1991; Stromberg 1993. Many of these changes in the structure, function, and composition of the riparian community can be expected to occur where access is allowed. Effects to riparian vegetation can include changes in plant species composition, such as a transition from brush to grass to forbs; a reduction of floodplain and streambank vegetation, including vegetation which overhangs banks or is found within the water column; decreases in plant vigor; alteration of plant growth form, such as lateral branching; changes in the timing and amount of organic energy leaving the riparian zone, and; elimination of riparian plant communities, which may occur as a result of lowering of the water table so that xeric plants replace riparian plants (Platts 1990, Fleischner 1994). Species diversity and structural diversity may be substantially reduced and nonnative species may be introduced through spread in cattle feces. Reduction in riparian vegetation quantity and health, plus shifts from deep-rooted to shallow-rooted vegetation contribute to bank destabilization and collapse and production of fine sediment (Meehan 1991). Loss of riparian shade results in increased fluctuation in water temperatures with higher summer and lower winter temperatures (Karr and Schlosser 1977, Platts and Nelson 1989). Litter is reduced by trampling and churning into the soil thus reducing cover for soil, plants, and wildlife (Schulz and Leininger 1990). The capacity of the riparian vegetation to filter sediment and pollutants to prevent their entry into the river and to build streambanks is reduced (Lowrance *et al*. 1984; Elmore 1992). Channel erosion in the form of downcutting or lateral expansion may result (Heede and Rinne 1990; USBLM 1990).

Although the majority of the riparian areas within the project area within and adjacent to the allotments are excluded from livestock use through fencing and topographic features, some areas remain accessible to livestock. Even where fencing exists, there will inevitably be some use of the riparian area due to cows gaining access through broken fences. Fence maintenance is imperative to improving the watershed and reducing direct impacts to the spikedace, improving habitat for the loach minnow, and reducing impacts to the critical habitat for both species.

Livestock, if allowed access to riparian corridors designated as critical habitat (as proposed in the West Bear/Del Rio, Perkinsville, and Brown Springs allotments) during extended time periods especially during growth periods, are likely to directly alter streamside vegetation in several areas by trampling, rubbing, and feeding on herbaceous plants and shrubs. Use and removal of herbaceous vegetation leads to changes in species composition, species diversity, and biomass, while use and removal of woody vegetation can lead to changes in foliage cover, structural height diversity, and stand reproduction. Livestock may also have indirect effects on riparian vegetation by compacting the soils and causing increased runoff and decreased water availability to plants, and by increasing soil temperatures which can lead to increased evaporation due to the removal of vegetation (Kauffman and Krueger 1984).

Aquatic Habitat

The effects of grazing on aquatic habitat are varied, and can include alteration of streambanks, the reduction of shade, a decrease in cover, and subsequent changes to stream temperatures. Because streams in heavily grazed areas contain more fine sediment, streambanks become more unstable, banks are less undercut so that potential fish habitat is eliminated, channels widen, water becomes more shallow, and channel substrates are altered by accrual of eroded sediment which causes embeddedness. The alteration of streambanks is particularly harmful as fish often adapt their survival to this habitat edge as the overhanging banks provide cover, control water velocities, and supply incoming terrestrial foods (Platts 1990).

3) Alteration of the Faunal Community

Livestock use of the riparian corridor causes changes in species composition and community structure of the aquatic and riparian fauna, in addition to floral changes already addressed. The aquatic invertebrate community may change from its baseline because of altered stream channel characteristics, because of sediment deposition, or because of nutrient enrichment (Rinne 1988; Meehan 1991; Li *et al*. 1994). This change in the food base of many aquatic vertebrates, particularly fish, may contribute to loss of, or change in, the vertebrate community. In addition, the structure and diversity of the fish community may shift due to changes in availability and suitability of habitat types (Storch 1979; Van Velson 1979). Livestock grazing may lead to loss of aquatic habitat complexity, thus reducing diversity of habitat types available and altering fish communities (Li *et al.* 1987).

4) Effects from Grazing-related Structural Elements

Continued livestock use on the allotments requires that roads and fences be maintained. Roads are of concern since they are often contributors of sediment to stream courses. Fences are of concern because where they are near streams and/or in floodplains, they assist in the creation erosion channels and can negatively effect the channel banks. The continued use and maintenance of existing waterlots and stocktanks within the allotments increases the potential for both authorized and unauthorized stocking of non-native fish and bullfrogs. Flood events may then cause breaches in these water developments and allow non-native fish to enter tributaries and major waterways.

Upper, Middle, and Lower Reaches of the Verde River: Specific Analysis of Effects

Upper Verde River: Critical Habitat, Spikedace, and Loach Minnow

As noted in the Environmental Baseline, averaged soil conditions for all nine allotments in the upper reach of the Verde River were determined to be 36.8% satisfactory, 34.6% impaired, and 28.6% unsatisfactory. The upper Verde River, according to fish survey data generated by the USFS and the AGFD and presented herein, may potentially be occupied by spikedace. Impacts to spikedace and designated critical habitat for spikedace and loach minnow from livestock grazing can occur as direct and indirect effects to the Verde River, or its tributaries. Generally, direct impacts can be expected from livestock activity within the channel itself, or the associated riparian zone and have been described above. As stated previously, two allotments within the upper reach provide direct access to the Verde mainstem, designated critical habitat, which has been designated as critical habitat. These allotments are the West Bear/Del Rio and the Perkinsville allotments. For a detailed discussion of the degree of access for each of these allotments, see the Description of the Proposed Action section of this opinion.

Access will occur during part of the spikedace and loach minnow spawning seasons which occur from mid-March to May and late March to early June, respectively. Specifically, direct access to critical habitat, potentially occupied by spikedace, will occur on the West Bear/Del Rio and Perkinsville allotments during river crossings. However, these access points are a considerable distance from Burnt Ranch where a single spikedace was last observed in 1999. Direct take of spikedace from livestock in the river has never been documented but may potentially occur from livestock in the river creating hazards to fish and larvae and/or crushing or dislodging eggs deposited on the steam bottom. Indirect effects are likely to include the suffocation of eggs due to increases in sediment, and removal of riparian vegetation which may influence water temperatures and impact prey availability. Repeated access to the river may result in sloughing off and trampling of streambanks which may increase embeddedness and sedimentation and influence changes in stream morphology. Therefore, it is reasonable to ascertain the effects to specific constituent elements of critical habitat for spikedace to include 1) reduction of suitable living areas for juvenile spikedace resulting from reductions of instream cover; 2) reduction of living areas for larval spikedace resulting from reductions of instream cover; 3) adverse effects to sand, gravel, and cobble substrates from increased sedimentation and substrate embeddedness; 4) increased water temperatures potentially exceeding the preferred range of 1-30°C (35-85°F) from alterations in riparian shading, and; 5) a reduction of the aquatic macroinvertebrate food base resulting from degradation of the macroinvertebrate habitat. Consequently, as a result of these direct and indirect effects to spikedace and potentially occupied critical habitat, incidental take of spikedace may occur, but is not reasonably certain to occur within this reach unless significant changes in conditions become realized whereby triggering re-initiation of consultation with the Service.

Loach minnow have not been observed in the upper reach of the Verde River since the 1930's and are believed to be extirpated from the Verde River watershed as a result of habitat

destruction and the introduction of nonnative fish species (and crayfish). Consequently, in the absence of loach minnow, incidental take of loach minnow is not expected to occur within this reach. However, adverse impacts to specific constituent elements of critical habitat for loach minnow are likely to occur and will include 1) a reduction of living areas for larval, juvenile, and adult loach minnows by increased sedimentation and embeddedness to gravel, cobble, and rubble substrates; 2) increased water temperatures potentially exceeding the preferred range of 1-30°C (35-85°F) from alterations in riparian shading, and; 3) a reduction of the aquatic macroinvertebrate food base resulting from degradation of the macroinvertebrate habitat.

Conditions of the uplands will likely continue to have serious, indirect effects on downstream aquatic habitats. Effects from sedimentation of tributaries, including intermittent and ephemeral channels, inhibit their ability to act as important buffers between upland impacts and the mainstem or perennial stream (Erman *et al.* 1977, Mahoney and Erman 1992, Osborne and Kovacic 1993). The areas of diminished watershed and riparian conditions found within various allotments within this watershed are primarily the result of current and historical livestock grazing and juniper encroachment that have resulted in reduced ground cover, stream channel down cutting and widening, gully formation, enhanced transport of fine sediment (as noted in the Horseshoe and Antelope Hills allotments), alteration of hydrologic processes, and general degradation of aquatic, fisheries and riparian conditions.

Deteriorating condition of the uplands will likely continue to be observed in 1) the Limestone allotment where a 91% reduction of stocking density was spurred by a continued downward trend in range condition, a rating of poor to very poor on nearly all acres, and an unacceptable soil loss on some acres exacerbating erosion and affecting the integrity of soil conditions of allotments farther down slope, as well as noted juniper encroachment; 2) the West Bear/Del Rio allotment where approximately 48% of the allotment was noted by the PNF as having unsatisfactory soil conditions resulting in continued inhibition of the soil's function of minimizing excessive erosion; 3) the Muldoon allotment where soil function was noted by the PNF as limited by compaction, sheet erosion, gullies, poor nutrient cycling and sparse vegetative cover; 4) the China Dam allotment which is experiencing limited soil function due to compaction resulting in reduction of infiltration capacity in addition to a high percentage of bare soil (47 - 78%) and the fact that old roads and road drainage initiating and contributing to gully formation coupled by a continued livestock concentration in valley bottoms, accelerating the erosion process (USFS 2001a); 5) the Sand Flat allotment where soil conditions are limiting and juniper encroachment is high, will continue to impair the soil's ability to allow for proper infiltration and retention of moisture, resist erosion, and cycle nutrients; 6) the Perkinsville allotment where 43.7% of soil condition was rated as unsatisfactory by the PNF as well as an increasing trend in juniper density; 7) the Antelope Hills allotment which is experiencing limited soil function as defined by increased areas of bare soil, a lack of organic matter on the soil surface, areas of high compaction, and a lack of proper nutrient cycling (USFS 2001a) in addition to active gully erosion; and 8) the Horseshoe allotment where areas of low vegetative ground cover have increased the likelihood for fine sediments to be transported significant distances, including the cumulative addition of sediments from gullies and ephemeral channels, ultimately to the Verde

River (USFS 1996) and PNF observations noting that past improper grazing practices have lowered the capacity of the sedges to aggregate sediments which has diminished riparian function in terms of mitigating sedimentation (USFS 1996). Livestock grazing within all of the allotments located in the upper Verde River watershed, with the exception of perhaps the Tule allotment and consistent with the effects above, will generate unnatural conditions favorable for sediment migration that enters occupied critical spikedace habitat during runoff events, adversely modify critical habitat constituent elements, whereby adversely affecting the species.

Middle Verde River: Critical Habitat, Spikedace, and Loach Minnow

The Environmental Baseline, above, averaged soil conditions for all five allotments in the middle reach of the Verde River which were determined to be 45.9% satisfactory, 3.3% impaired, and 50.7% unsatisfactory. Since direct access to critical habitat within the middle reach of the Verde River is not anticipated, effects to critical habitat are expected to occur only indirectly from livestock grazing in the uplands and the associated ephemeral tributaries to the Verde mainstem.

The presence of spikedace has not been confirmed within the middle reach of the Verde River but potential for its presence exists due to inter-channel migration of the species within the Verde mainstem. Effects to specific constituent elements of critical habitat for spikedace may include 1) a reduction of the availability of sand, gravel, and cobble substrates from increased sedimentation and substrate embeddedness, and; 2) a reduction of the aquatic macroinvertebrate food base.

Likewise, impacts to specific constituent elements of critical habitat for loach minnow may include 1) a reduction of living areas for larval, juvenile, and adult loach minnows by increased sedimentation and embeddedness to gravel, cobble, and rubble substrates, and; 2) a reduction of the aquatic macroinvertebrate food base. Loach minnow have not been observed in the middle reach of the Verde River since the 1930's and are believed to be extirpated from the Verde River watershed as a result of habitat destruction and the introduction of nonnative fish species (and crayfish). Consequently, in the absence of loach minnow and the likely absence of spikedace, incidental take of either species is not expected to occur within this reach.

As observed in the upper reach of the Verde watershed, approximately 51% of the soil conditions have been described as being in unsatisfactory conditions, as a function of soil condition ratings. Examples of deteriorating conditions in the uplands within the middle reach of the Verde can be observed in various allotments such as 1) the Jerome allotment where upland soils have been noted as highly erosive has contributed to instability and aggradation due to increased sediment loading of certain channels (USFS 2001a) (we expect these conditions to continue during this permit, and; 2) the Verde allotment where herbaceous ground cover has been reduced as a result of juniper encroachment and off-highway vehicle users are creating many new trails further exacerbating the loss of vegetative ground cover and, ultimately, limiting soil function (USFS 2001a).

Therefore, it is reasonable to expect that indirect effects from continued grazing in the uplands will be mildly to moderately exacerbated by already-deteriorated soil conditions and their ability to moderate the transport of sediment to larger tributaries and eventually to the Verde River. One should also consider the synergistic relationship of watershed impacts that have occurred upstream, in the upper Verde River, with the mainstem's ability to withstand additional sediment loading while maintaining adequate aquatic habitat conditions.

Lower Verde River: Critical Habitat, Spikedace, and Loach Minnow

Again, as the Environmental Baseline section stated, soil conditions for both allotments were averaged in the lower reach of the Verde River and were determined to be 55.8% satisfactory, 35.8% unsatisfactory, and 8.4% impaired. Neither spikedace or loach minnow are currently occupying the lower reach of the Verde River. However and as noted previously, this reach is designated as critical habitat for both species and is important for consideration of the effects of the proposed action on maintaining desired condition for the purpose of reintroduction of one or both of the listed fish species. Both the Brown Springs and Sycamore allotments provide access for livestock to the Verde River. Specifically, in the Brown Springs allotment, livestock are provided access to the Verde River for a duration approximately 5 to 6 months, occurring every 12 to 14 months. In the Sycamore allotment, perennial reaches have been excluded from livestock activity, however non-perennial reaches are available to livestock on a rotational management system. Although over half of the watershed within the lower Verde River is considered as satisfactory, similar direct and indirect effects from livestock grazing described for the upper and middle reaches are likely to occur within the lower reach. This assumption is largely based on the synergistic, cumulative effects of grazing activity upstream and the direct access to the mainstem attributed to livestock within the lower reach.

Loach minnow have not been observed in the lower reach of the Verde River since the 1930's and are believed to be extirpated from the Verde River watershed as a result of habitat destruction and the introduction of nonnative fish species (and crayfish). Consequently, in the absence of loach minnow, adverse effects (take) to loach minnow are not expected to occur within this reach. Coincidentally, spikedace are also believed to be extirpated from the Verde River watershed as a result of habitat destruction and the introduction of nonnative fish species (and crayfish). Consequently, in the absence of spikedace and loach minnow, incidental take of either species is not expected to occur within this reach.

Three tributaries, Oak Creek, Beaver/Wet Beaver Creek, and West Clear Creek, which are designated as critical habitat for spikedace and loach minnow, are within proximity to the action area. However, only the confluences of these tributaries with the Verde River are within the action area. The tributaries themselves are not anticipated to be affected by the proposed action and, consequently, are not considered in this opinion.

As a review of the direct and indirect effects associated with livestock grazing in the arid southwestern U.S. and the watersheds which reside within (including the Verde River complex), Table 5 is provided below which lists the effects of grazing, the resulting effects on biological needs of the fish, and the cause of the potential harm or harassment of the fish themselves. This discussion is based on fundamental principles of stream ecology, fish habitat, and grazing

literature (Barber *et al*. 1970, Karr and Schlosser 1977, Anderson 1978, Gifford and Hawkins 1978, Duff 1979, Dobyns 1981, Barber and Minckley 1983, Blackburn 1984, Kauffman and Krueger 1984, Skovlin 1984, Platts and Nelson 1985, Abarca 1987, Chaney *et al*. 1990, Orodho *et al*. 1990, Platts 1990, Armour *et al* 1991, Propst and Bestgen 1991, Elmore 1992, Naiman 1992, Elmore and Kauffman 1994, Rosgen 1994, Myers and Swanson 1995, Fleischner 1994, Belsky and Blumenthal 1997, Belsky *et al.* 1999, Briggs 1996, Sayre 2001).

Table 5. The effects of grazing, resulting effects on biological needs of the fish and potential harm or harassment of the fish themselves.

Grazing Effect	Results in an Adverse Affect of Critical Habitat from	Which May Adversely Affect Spikedace or Loach Minnow by
Decrease in roughness in the uplands, with increase in velocities and amounts of water coming off of the watershed	an increase in turbulence	resulting in too little or too much oxygen in the water.
	An increase in the volume of flood flows with a decrease in their duration, leading to entrainment of fish in deep or rapidly flowing water	causing physical damage to the fish themselves.
Decrease in overhanging vegetation which shades the water, either directly by grazing, or indirectly by causing channel instability and changes in substrate that disallow riparian vegetation regeneration and persistence	an increase in insolation	resulting in too little or too much oxygen in the water.
	a decrease in channel shading	changing temperatures outside of the tolerance zone of fish.
Increase in turbidity in the water when excess sediments are transported into the stream system off of the watershed due to removal of vegetation in upland areas	a decrease in ability to locate prey items	starvation.
	a decrease in the number or type of prey items	starvation.
	a decrease in the ability to locate a mate	delay in or prevention of reproduction
Changes to temperature regimes, flow patterns, and/or oxygen levels due to changes in flow patterns, amount of water in the channel, and alteration of riparian vegetation	a decrease in the number of type of prey items	starvation.
Addition of excess sediment to the channel, which fills in crevices in the rocks used by fish	a decrease in available crevices for suitable cover	predation.
	a decrease in suitable sites/surfaces for egg deposition	prevention of successful reproduction.
	a decrease in successful hatching due to smothering of deposited eggs	prevention of successful reproduction.

Grazing Effect	Results in an Adverse Affect of Critical Habitat from	Which May Adversely Affect Spikedace or Loach Minnow by
Alteration of the channel morphology, resulting in fewer shallow riffle complexes	entrainment of fish in deep or rapidly flowing water	causing physical damage to the fish themselves.
	a decrease in abundance of suitable habitat	delay in or prevention of successful reproduction.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local 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.

Loach Minnow, Spikedace and Critical Habitat

Cumulative adverse effects to the stream ecosystems and watersheds come from many small actions that do not individually threaten the entire system, but taken together result in deterioration. The incremental nature of sediment deposition from many sources in the watershed is a classic case of cumulative effects, where the whole rather than one source is the primary concern (Waters 1995).

Although the majority of the Verde River complex is managed by the PNF, current and future management of non-Federal lands along the Verde River is expected to contribute to the degradation of loach minnow and spikedace habitat. Unregulated livestock grazing on private in-holdings will continue to severely reduced the quantity and diversity of riparian vegetation, which increases potential streambank erosion. The increase in bank erosion has serious detrimental sedimentation effects on loach minnow and spikedace habitat. Other actions on private lands including the illegal transportation and introduction of nonnative fish species (and crayfish) pose a continued cumulative threat to the spikedace and loach minnow. To ensure the continued existence of these species, cumulative adverse effects of many smaller actions should be reduced.

CONCLUSION

Spikedace/Critical Habitat

After reviewing the current status of the spikedace, the environmental baseline for the action area, the effects of the proposed action of livestock grazing on all three reaches of the Verde River complex considered in this biological opinion, and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the spikedace, or result in the destruction or adverse modification of its critical

habitat. We present these conclusions for the following reasons:

1. The Forest has installed fencing around the majority of the riparian corridor and implemented two monitoring regimes in order to reduce the adverse effects of the action to the spikedace and its critical habitat.

2. The Forest proposes to take action to ensure that range and/or soil condition does not deteriorate on Forest lands in the watershed of spikedace habitat, and to improve range and/or soil condition in areas of fair, poor, unsatisfactory, or impaired condition.

3. If upland conditions remain status quo or improve, the condition of the critical habitat of the upper Verde River will likely continue to provide the constituent elements essential for spikedace (with the exception of the threats associated with the presence of non-native fish species, including crayfish). The current integrity of the aquatic habitat is due largely to exclusion from livestock grazing within the riparian corridor. Livestock exclusion is anticipated to continue with exception to the West Bear/Del Rio and Perkinsville allotments where access to the Verde River and riparian community is to occur. However, these access points are a considerable distance from the last location, the Burnt Ranch, where spikedace was last observed in 1999.

Loach Minnow/Critical Habitat

After reviewing the current status of the loach minnow, the environmental baseline for the action area, the effects of the proposed action of livestock grazing on all three reaches of the Verde River complex considered in this biological opinion, and the cumulative effects, it is the Service's biological opinion that the action, as proposed is not likely to jeopardize the continued existence of the loach minnow, or result in the destruction or adverse modification of its critical habitat. We base our biological opinion on the following reasons:

1. The Forest has installed fencing around the majority of the riparian corridor in order to reduce the adverse effects of the action to the loach minnow and its critical habitat.

2. The Forest proposes to take action to ensure that range and/or soil condition does not deteriorate on Forest lands in the watershed of loach minnow habitat, and to improve range and/or soil condition in areas of fair, poor, unsatisfactory, or impaired condition.

3. If range and/or soil conditions remain status quo or improve, the condition of the critical habitat of the upper Verde River will likely continue to provide the constituent elements essential for loach minnow (with the exception of the threats associated with the presence of non-native fish species, including crayfish).

4. Loach minnow are considered extirpated from the Verde River complex at the time of this consultation.

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 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.

Statement of Finding(s) Regarding Take

Spikedace

Upper Verde River

The Service has thoroughly examined the available information pertaining to the current and proposed grazing actions on the Limestone, West Bear/Del Rio, Muldoon, China Dam, Sand Flat, Tule, Perkinsville, Horseshoe, and Antelope Hills allotments. At this time and given the limited information available, the Service is unable to conclude that incidental take of spikedace is reasonably certain to occur within this portion of the action area during the lifetime of the action. The premise for this finding resides in the consideration of two main factors. Specifically, the most significant factor is the very small population size and elusive nature of the species which inhibits the effectiveness (and/or the confidence) of spikedace presence/absence survey techniques. Second, if the species is present but not detected, uncertainties on their location and abundance precludes our ability to predict or articulate the method, timing, or location of adverse affects incurred either directly or indirectly from the proposed action.

Middle and Lower Verde River

Given the historic and current data available, the Service is reasonably certain that spikedace are currently not occupying the middle or lower reaches of the Verde River within the action area.

Loach Minnow

Upper, Middle, and Lower Verde River
As stated above, loach minnow have not been identified in the Verde River system since the 1930's. Due to the current absence of loach minnow within the project area, the Service anticipates that no take of individual loach minnow will result from the proposed action.

DEPOSITION OF DEAD OR INJURED LISTED ANIMALS

Upon discovery of a dead or injured threatened or endangered animal, initial notification must be made to the Service's Division of Law Enforcement, Federal Building, Room 8, 26 North McDonald, Mesa, Arizona (480/835-8289) within three working days of its finding. Written notification must be made within five calendar days and include the date, time, and location of the animal, a photograph, and any other pertinent information. The notification shall be sent to the Law Enforcement Office with a copy to this office. 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. Should discovery of either spikedace or loach minnow occur during the duration of project implementation, reinitiation of consultation may be necessary pursuant to 50 CFR §402.16.

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. The Service recommends the following:

1. The Forest Service should consider reducing livestock utilization levels or using conservative standards in stubble height within the allotments to more rapidly improve watershed conditions.

2. The Forest Service should consider further limiting all livestock access, including crossings, from the Verde River to provide maximum protection and recovery potential for loach minnow and spikedace.

3. The Forest Service should consider identifying the primary sources of sediment (or areas of currently excessive erosion) input into the Verde River and develop and implement programs to mitigate those impacts.

4. The Forest Service should consider implementing appropriate portions of the Loach Minnow and Spikedace Recovery Plans. The Forest Service should consider reintroduction of these species into historical habitats on the National Forest lands.

5. The Forest Service should consider implementing a basin-wide program for monitoring of loach minnow, spikedace, and its accompanying native fish community along the entire length of the Verde River, occurring within Forest Service and/or private property (by establishing access agreements). Descriptive linear habitat mapping should be considered along all occupied, suitable, or potential habitat on all reaches of the Verde River under the jurisdiction of the PNF as well as on the private property (with access agreements) to identify suitability or capability for spikedace and loach minnow as well as other components of the native fish community. The Service recommends monitoring be conducted by journey-level fish biologists with expertise in southwestern fishes and desert stream habitats. The Service recommends that the monitoring program be coordinated with any existing monitoring or surveying efforts to avoid over sampling. The Service recommends that monitoring protocols and habitat suitability criteria be agreed upon with the New Mexico Game and Fish Department, the AGFD, other appropriate entities, and the Service to ensure consistency, validity, enhance agency collaboration, and avoid redundancy of effort.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the action outlined in the this biological opinion. 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 retained (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 affect listed species or 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 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. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

The Service appreciates your cooperation throughout this consultation process. For further information, please contact Jeff Servoss (x237) or Debra Bills (x239). Please refer to the following consultation numbers for the various allotments: Antelope Hills (2-21-94-I-386, 000089RO, 2-22-99-F-016, 2-21-01-F-011), Brown Springs (000089RO, 2-22-99-F-016), China Dam (2-21-95-I-440, 000089RO, 2-22-99-F-016), Copper Canyon (000089RO, 2-22-99-F-016), Horseshoe (2-21-94-I-386, 2-22-99-F-016), Jerome (000089RO, 2-22-99-F-016), Limestone (000089RO, 2-22-99-F-016), Muldoon (2-22-99-F-016), Perkinsville (2-21-94-I-386, 000089RO, 2-22-99-F-016), Sand Flat (2-22-99-F-016), Squaw Peak (000089RO, 2-22-99-F-

016), Sycamore (2-22-99-F-016), Verde (2-22-99-F-016), West Bear/Del Rio (2-22-89-F-071, 000089RO, 2-22-99-F-016), Young (000089RO, 2-22-99-F-016) and Tule (000089RO) in future correspondence concerning these projects.

Sincerely,

/s/ Steven L. Spangle
Field Supervisor

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Regional Forester, USFS Regional Office, Albuquerque, NM (Attn: Wally Murphy)
Forest Supervisor, Kaibab National Forest, Williams, AZ

Regional Supervisor, Arizona Game and Fish Department, Phoenix, AZ
John Kennedy, Habitat Branch Chief, Arizona Game and Fish Department, Phoenix, AZ
Native Fish Program Manager, Arizona Game and Fish Department, Phoenix, AZ
Center for Biological Diversity, Tucson, AZ
Director, Arizona Cattlegrower's Association, Phoenix, AZ

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Appendix A: Critical Habitat, Fish Survey Stations, and Grazing Allotments on the Prescott National Forest, Arizona