# Aquatic Specialist Report

## For

## Travel Management Rule Implementation

## Gila National Forest



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# Aquatics

## I. Analysis Question

What effects will changes to the current transportation system, motorized dispersed camping, motorized big game retrieval, and areas have on aquatic habitats and species?

## II. Affected Environment

The Gila National Forest (GNF) is situated within four river basins, the Gila-San Francisco, Mimbres, Little Colorado, and Rio Grande. Among them, species diversity, richness, and endemism are variable and depend, in part, on geologic history, relative proximity to more mesic and species-rich regions, climatic factors, and relative size and complexity of each drainage (Propst, 1999). The GNF has three manmade lakes completely or partially on National Forest lands and hundreds of miles of streams within forty-one $5^{th}$ code watersheds. Over the last 150 years, anthropogenic disturbances throughout the GNF have altered water temperatures, water volume, stream-flow patterns, and quantities of many streams. Additionally, introduction of non-native fish into streams has altered many aquatic systems. Riparian and wetland areas have been damaged locally by roads, recreational activities, ungulate grazing, water diversion, and timber harvest.

Aquatic features found on the GNF include both lotic (moving water) and lentic (still water) systems. There are over 1700 miles of perennial and intermittent stream habitat that occur in watersheds of the Gila National Forest within the project area. These streams contain a variety of aquatic species, most significant of which are those native resident species that are key for aquatic habitat management. These species' designations as endangered, threatened, sensitive and/or as management indicator species (MIS) emphasize the need for not only conservation, but also recovery efforts as part of interagency management programs throughout the project area.

## III. Relevant Laws, Regulations, and Policy

**Forest Service Manual 2670 and Forest Service Handbook 2609.25** provide direction regarding Forest Service sensitive species, which are identified by the Regional Forester. The Forest Service develops and implements management practices to ensure that rare plants and animals do not become threatened or endangered, and ensure their continued viability on National Forests.

**The Endangered Species Act of 1973** (16 USC 1531 et seq.) states that each Federal agency shall, in consultation with and with the assistance of the Secretary insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species. Section 7 of the ESA, as amended, requires the responsible federal agency to consult the U.S. Fish and Wildlife Service concerning threatened or endangered fish species under their jurisdiction. There are five fish species that are listed under the Endangered Species Act on the GNF: loach minnow, spikedace, Gila chub, Chihuahua chub, and Gila trout.

**Gila National Forest Land and Resource Management Plan** indentified the following relevant management standards and guidelines for fisheries resources across the entire forest:

C01,C11 Manage threatened, endangered, and sensitive animal, fish, and plant habitat to achieve delisting in a manner consistent with the goals established with the U.S. Fish and Wildlife Service and the New Mexico Department of Game and Fish in compliance with approved recovery plans.

C02 Manage riparian areas to protect the productivity and diversity of riparian dependent resources by requiring actions within or affecting riparian areas to protect and where applicable, improve dependent resources. Emphasize protection of soil, water, vegetation, and wildlife and fish resources prior to implementing projects.

C02 Give preferential consideration to resources dependent on riparian areas over other resources. Other resource activities may occur to the extent that they support or do not adversely affect riparian dependent resources.

C02 Wildlife coordination and improvement efforts will include emphasis on riparian and aquatic area management.

L04,L05 Road construction will be avoided in riparian areas.

LRMP standards and guidelines related to water quality are displayed in the Hydrology section.

## IV. Methodology and Analysis Process

### Analysis Framework

The project area includes all NFS lands within the administrative boundary of the Gila National Forest. The geographic extent of the direct, indirect, and cumulative effects analysis is generally confined to aquatic features of watersheds within this administrative boundary.

The area of analysis was chosen based on the potential for motorized routes on NFS lands to affect aquatic systems. It assumes that motorized routes located in watersheds on the GNF that influence larger riverine systems could have a measurable influence on these systems immediately adjacent to and downstream of the Forest. Therefore, this analysis will focus mainly on stream channels within the administrative Forest boundary, except in the case of larger riverine systems. This analysis includes portions of four major drainage basins: the Gila-San Francisco, Mimbres, Little Colorado, and Rio Grande. These four drainage basins include forty-one watersheds (5th field or HUC 5 watersheds) that are completely or partially within the administrative boundary of the GNF.

### Data & Methods

Conclusions reached in the analysis were based on data obtained from a number of sources; however, the majority of data sets were derived from GIS queries. Although the USDA Forest Service uses the most current and complete data available, data and product accuracy may vary based on differences in source accuracy, modeling or interpretation, and/or errors incurred while data sets were being created or revised.

Data for species occurrence is contained within GIS data sets that are updated regularly. The data is gathered from inventory and monitoring efforts conducted by the Gila National Forest, New Mexico Department of Game and Fish, U.S. Fish and Wildlife Service and other cooperators. Critical habitat designations for aquatic species were obtained from the U.S. Fish and Wildlife Service critical habitat mapper.

Measures or indicators were chosen to allow for comparison between the current condition of the aquatic resources and the relative risk to these resources from each alternative. Relative risks of the travel management alternatives were determined by analyzing three indicators: total road and motorized trail miles or road density and route use, total road miles within 300 feet of perennial or intermittent streams, and number of motorized route crossings on perennial and intermittent stream.

### Assumptions

A listing of general assumptions is provided at the beginning of Chapter 3. The following lists assumptions that are specific to aquatic wildlife.

- Habitats for the species being analyzed were assumed to be occupied if they contained the necessary life history elements.
- Human-caused disturbances near small streams in mountainous terrain disrupt natural biological processes and have the potential to adversely affect biological characteristics and fragment habitats.
- Research has concluded that sediment from roads can result in adverse effects to streams and aquatic habitats (Dissmeyer, 2000; Gucinski et al, 2001).
- Roads located near or that cross small streams in mountainous terrain can result in adverse effects to aquatic habitat.
- The overall effect of roads on aquatic habitat is related to the amount of sediment movement from road surfaces, and is highly variable within and among surface types. Sediment movement is related to levels of maintenance, road drainage (Clinton and Vose, 2003), and amount of use of the road (Maholland and Bullard, 2005; Reid and Dunne, 1984).
- All vehicle types result in the same amount of disturbance effect on aquatic dependent species.
- The reduction or elimination of vehicle traffic on a road near a stream will result in less sediment delivered from the road to the stream (Maholland and Bullard, 2005; Reid and Dunne, 1984).
- The density of roads and trails at the forest and watershed scale will not be substantially changed as a result of any of the action alternatives for at least the next 20 years because all of the action alternatives involve the closure of roads and unauthorized routes to vehicle use by the public rather than the physical removal of roads.
- Habitat is being affected to some degree by the cross-country motorized travel. Where motorized use is prohibited, riparian habitats will improve over the long term due to passive restoration and revegetation.

Because of the limitation posed by the assumptions described above, the analysis provided here is a relative risk assessment of each of the action alternatives compared to the No Action alternative.

## V. Effects Analysis

### Effects of the No Action Alternative

The No Action Alternative represents no change from current management and consists of the system of roads, motorized trails, and areas open to motorized cross-country travel identified as the current travel system. The no action alternative includes 302 miles of National Forest motorized routes within three hundred feet of perennial and intermittent streams and rivers and 918 stream crossings. Motorized routes include 5,221 miles of routes that are open to all users and vehicle types and 16 miles of less than fifty inch trail that are open to all terrain vehicle uses. Stream crossings on perennial and intermittent streams and rivers consist of 882 low water crossings, 5 bridges, and 31culverts. Under the No Action Alternative the Forest (2,441,804 Acres) is open to motorized cross-country travel and motorized dispersed camping, although many areas are not actually available due to steep slopes, rocky conditions, and/or dense timber. In open areas, vehicles can legally travel to any place possible and as a result user routes are created, riparian areas are impacted by indiscriminate motor vehicle use, and stream banks are often directly impacted when vehicles cross streams.

**Effects Common to all Action Alternatives**

***General Effects***

For this analysis, it is assumed that when a road is closed it will continue to have impacts on the aquatic system because all of the action alternatives involve the closure of roads and unauthorized routes to vehicle use by the public rather than the physical removal of roads. However, curtailing or reducing use on those routes that are closed or open only by written permit will decrease impacts.

The effects of roads on aquatic organisms are well documented. Roads and trails disturb soils and increase the potential for erosion and sediment transport and deposition in streams. Likewise, motorized and non-motorized uses (motorcycles, ATVs, horses, mountain bikes, hikers) can further disturb soils and increase potential for erosion and sediment delivery. Surface erosion from forest roads affects the fine sediment budget and may impose a chronic condition of sediment inputs to streams directly affecting the stream substrate and the health of aquatic life (Luce et al., 2001). Chronic erosion from roads can greatly reduce and aquatic system’s integrity, and in some cases can be the sole source of sediment input (Switalski et al., 2004). Sediment concerns are generally highest when roads and trails are not sufficiently drained. Water and sediment can concentrate on roads and trails during spring snowmelt runoff or periods of intense rain and be delivered to streams. With sufficient drainage, water and sediment from upland segments roads can be diverted, filtered through forest vegetation, and not routed to streams. As such, upland segments of roads can generally be designed to mitigate sediment delivery concerns. The primary concern is erosion and sediment delivery from roads that are near streams and that cross streams. Fine material, or sediment, is a key physical element to focus on when attempting to delineate land-management effects on stream habitat and biota (Rinne, 1990). Excessive fine sediment input to a stream can fill pool habitat and reduce both summer and winter rearing habitat for juvenile fish (Heede and Rinne 1990). Native, desert fish species such as the loach minnow require clean gravel-cobble substrates. Rinne (1989 ) found that loach minnow used shallow, moderately swift flow areas with gravel to cobble substrates. Rinne (1991) also found that spikedace were absent from areas where fine silt and sand had accumulated. Neary et al. (1996) documented that spikedace numbers increased almost three-fold when the fine component of the substrate decreased from about 27 percent to 7 percent.

A synthesis of road impact information can be found in “Forest Roads: A synthesis of scientific information” (Gucinski and Furniss 2001). Some of the key findings from this document that relate to travel management include both physical and biological effects:

Physical effects include:

- “Roads affect geomorphic process by four primary mechanisms: Accelerating erosion from the road surface and prism itself by both mass and surface erosion processes; directly affecting channel structure and geometry; altering surface flowpaths, leading to diversion or extension of channels onto previously unchannelized portions of the landscape; and causing interactions among water, sediment, and woody debris at engineered road-stream crossings.”
- “Roads have three primary effects on water: they intercept rainfall directly on the road surface and road cutbanks and intercept subsurface water moving down the hillslope; they concentrate flow, either on the surface or in an adjacent ditch or channel; and they divert or reroute water from flowpaths that it would otherwise take if the road were not present.”

These physical effects lead to the following biological effects:

- “Increased fine-sediment composition in stream gravel has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes.”
- “The effects of roads are not limited to those associated with increases in fine-sediment delivery to streams; they can include barriers to migration, water temperature changes, and alterations to streamflow regimes.”
- “Road-stream crossings have been shown to have effects on stream invertebrates. Hawkins and others found that the aquatic invertebrate species assemblages (observed versus expected based on reference sites) were related to the number of stream crossings above a site.”
- “Several studies at broad scales document aquatic habitat or fish density changes associated with road density or indices of road density.”

**Direct and Indirect Effects**

Direct and indirect effects to fisheries, aquatic, and riparian habitats as a result of designating motorized routes and use classes throughout non-wilderness watersheds of Gila National Forest are essentially the same for all alternatives and differ primarily in relation to the indicators for number of motorized route miles within stream buffer zones (300 ft) and number of stream crossings. Indirect effects to aquatic and aquatic-dependent species resulting from roads and motorized vehicle use include habitat alteration due to elevated levels of in-channel sediment delivery, riparian habitat alteration, and to a lesser degree collection (includes fishing and hunting). Common direct effects occurring in all alternatives include:

- The direct and indirect physical loss of riparian habitat and functions within the 100-year floodplain, as a result of uses in those areas destroying vegetation.

- The direct and indirect creation of drainage pathways that follow route treads and alter surface water pathways of both the immediate stream, as well as its associated high water pathways, throughout the 100-year floodplain, during periods of flooding.

- The indirect conversion of dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment, following route tread pathways, leading from both the intercepted adjacent watershed areas, as well as channelized run-off flowing directly down a route tread.

- The creation of direct and indirect impact to streams, habitats, and aquatic species at route crossing points. The direct channel disturbances of stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation.

- The direct dislocation of fish spawning activity within ford crossings that can occur depending on fish species and spawning suitability of stream substrate and flows.

- Indirect decrease in fish egg hatching success and subsequent fish populations due to sedimentation.

Based on the natural history of U.S. Fish and Wildlife endangered, threatened, and candidate species, USDA Forest Service Southwestern Region sensitive species, and Gila National Forest Management Indicator Species, and the potential for disturbance resulting from the change to route designations, the following analysis framework was developed to address the indicator measures.

### ***Roads Within 300 Feet of Streams***

The closer a road is to a stream system, the greater the impacts on the stream and the organisms inhabiting it. Roads directly adjacent to streams can impact streams by channelizing the stream, eliminating streamside vegetation, and introducing sediment into the stream. Where roads are close to streams they affect the stream more directly (Luce et al., 2001). Sediment transport from roads can exceed 300 feet ( Burroughs and King, 1989; Belt et al., 1992) Road-stream crossings are addressed separately. Table 3.1 displays the total miles of National Forest System (NFS) motorized routes and the percent decrease or increase in miles of motorized routes within 300 feet of streams and rivers for all alternatives.

**Table 3.1—Miles of NFS motorized routes within 300' of perennial and intermittent streams and rivers.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of NFS Motorized Roads** | 298 | 230 | 138 | 102 | 179 | 175 |
| **Miles of NFS Administrative Roads** | 0 | 42 | 61 | 58 | 52 | 52 |
| **Miles of NFS Motorized Trail < 50"** | 4 | 14 | 7 | .32 | 14 | 14 |
| **Miles of NFS Administrative Motorized Trail < 50"** | 0 | 1 | 3 | 3 | 1 | 1 |
| **Motorized NFS 2 Wheel Vehicle Trail** | 0 | 15 | 0 | 0 | 0 | 0 |
| **Total Miles of NFS Motorized Routes** | 302 | 302 | 209 | 163 | 246 | 242 |
| **Change in Number of Miles of NFS Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -31% | -46% | -19% | -20% |

Alternative B, the No Action alternative, has the greatest length of motorized routes within 300 feet of streams and rivers, followed by Alternative C, Alternative F, and Alternative G, respectively. When compared to Alternative B, Alternatives E and D reduce the miles of road within 300' of streams and rivers by 46% and 31% respectively. Alternative E has the fewest miles of motorized routes within 300 feet of streams and rivers of any alternative. Alternative E presents the lowest relative risk to aquatic species and habitat related to the impacts from motorized routes. The relative risk to aquatic habitat and species is greatest from Alternatives B and C. Alternatives F and G are similar and moderately reduce the level of relative risk to aquatic species and habitat with Alternative G having six fewer miles of motorized route than Alternative F.

***Road-stream Crossings***

Road-stream crossings are areas where the impacts of roads are the greatest in terms of channel impacts, sediment, and potential movement barriers. There is a high correlation between road-stream crossings and fine sediment (McCaffery et al., 2007) Numbers of crossings was obtained for the proposed action by visiting the crossings and collecting location data that was utilized to construct a spatial GIS layer. The number of road crossings for roads that were motorized in other alternatives and not the proposed action were obtained by utilizing GIS layers and intersecting roads and streams. The stream crossing number for roads not included in the proposed action may not be accurate due to inaccuracies in the GIS data layers. While absolute counts of stream crossings in this analysis are not reliable, the relative differences between alternatives is considered "very good" since the same data sets were used for each alternative and actual crossing locations have been collected for most roads. Table 3.2 displays the number of stream crossings by NFS motorized routes and the percent increase or decrease in that number, when compared to Alternative B.

**Table 3.2—Number of NFS road crossings on perennial and intermittent streams by crossing type.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 883 | 635 | 352 | 237 | 518 | 500 |
| **Low Water Administrative Road** | 0 | 141 | 182 | 153 | 160 | 160 |
| **Low Water Motorized Trail <50”** | 0 | 34 | 1 | 0 | 44 | 44 |
| **Low Water Administrative Motorized Trail <50”** | 0 | 4 | 8 | 8 | 4 | 4 |
| **Bridge** | 5 | 5 | 5 | 5 | 5 | 5 |
| **Culvert** | 31 | 31 | 29 | 25 | 30 | 30 |
| **Total Number of Crossings** | 919 | 850 | 577 | 428 | 761 | 743 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | -8% | -37% | -53% | -17% | -19% |

Alternative B, the No Action alternative, has the greatest number of stream and river crossings, followed by Alternative C, Alternative F, and Alternative G, respectively. When compared to Alternative B, Alternatives E and D reduce stream and river crossings by 50% and 33% respectively. Alternative E has the fewest crossings of any alternative. Alternative E presents the lowest relative risk to aquatic species and habitat related to the impacts from NFS motorized route stream crossings. The relative risk to aquatic habitat and species is greatest from Alternatives B and C. Alternatives F and G are similar and moderately reduce the level of relative risk to aquatic species and habitat with Alternative G having 19 fewer stream crossings than Alternative F.

### Route Density and Use

An evaluation of road and motorized trail density indicates the potential for erosion, adverse water quality impacts, and modified hydrology. Roads and the trails used by motorized vehicles can intercept, concentrate, and divert water. Their impacts can be mitigated, but not completely eliminated, if they are to serve as travel routes. This analysis of road and motorized trail density is based on the general assumption that areas with greater road and motorized trail density generally have a greater relative risk of adverse impacts.

Route density is used by the U.S. Fish and Wildlife Service and National Oceanic and Atmospheric Administration’s National Marine Fisheries (NOAA Fisheries) as one way to measure watershed condition. The joint agencies’ general recommendation is that a given watershed should have less than 2.5 miles per square mile of road system; if in excess, that factor is considered to be not properly functioning. While recommendation is not a Regional standard, it was utilized to display effects on aquatic species in the Biological Assessment for the 11 Land and Resource Management Plans (LRMPs) of the National Forests and Grasslands in the Southwestern Region (USDA Forest Service 2004). That Biological Assessment was prepared in response to a need for re-initiation of Endangered Species Act Section 7 consultation on the 11 LRMPs, and in that analysis, the route density for each National Forest was compared to this recommendation. Table 3.3 displays the route density, at the landscape scale, for each of the alternatives.

Because all of the action alternatives involve the closure of routes to vehicle use by the public rather than the physical removal of roads, the miles of NFS routes on the forest will not substantially change. Miles of NFS routes in all action alternatives, except Alternative E, slightly increase from the no action alternative. The miles of routes in Alternative E and the no action alternative are the same. The miles of NFS routes, and therefore densities, will not decrease until routes are physically removed, or, over time naturally decommission as vegetation establishes on them. Table 3.3 displays the total miles and density of NFS routes on the forest landscape for each alternative.

**Table 3.3--- Miles and Density of NFS Routes Existing on the Forest**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of NFS Routes*** | 5221 | 5290 | 5233 | 5222 | 5234 | 5234 |
| **Change in Miles of NFS Routes** | | +69 | +12 | +1 | +13 | +13 |
| **Density of NFS Routes* ($mi/mi^2$)** | 1.30 | 1.32 | 1.31 | 1.30 | 1.31 | 1.31 |
| **Change in Density of NFS Routes Expressed as a Percent (+ or – ) of the No Action Alternative** | | +1.5% | +0.7% | 0% | +0.7% | +0.7% |

*includes all NFS routes except those that have been previously decommissioned and that will remain so. For density calculations wilderness, research natural areas, and areas presently closed to off highway vehicles were excluded from the area of the Forest.

However, use of NFS routes by motorized vehicles differs in each of the action alternatives. The miles of NFS routes that are open to motorized use decreases in each of the action alternatives and routes that are open only to motorized use through a written permit and/or for administrative use increase, when compared to the no action alternative. Since, to some degree, sediment production by routes is related to motorized use of the route both of these route designations will reduce the relative risk to aquatic species and habitat by suspending use on non-motorized routes and reducing use on routes that are designated single purpose. Table 3.4 displays the miles of routes that will be non-motorized or designated as administrative for each of the alternatives.

**Table 3.4—Miles of NFS Routes with No or Reduced Use**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Routes Proposed to be Non-Motorized[1]** | 0 | 151 | 1261 | 1915 | 898 | 919 |
| **Miles of Routes Proposed to be Administrative Routes[2]** | 0 | 182 | 354 | 432 | 298 | 299 |
| **Miles of Routes with No or Reduced Use** | 0 | 333 | 1615 | 2347 | 1196 | 1218 |

1 Currently motorized routes that will be non-motorized.
2 Currently motorized, closed, decommissioned or user created routes proposed to become single purpose routes open for use by written permission and/or administrative use.

Alternative B will not non-motorized or place any routes in single purpose status and presents the greatest relative risk to aquatic species and habitat. Alternative E presents the greatest reduction in relative risk to aquatic species and habitat by non-motorizing and single purposing the most miles of routes. Alternative D reduces the relative risk to aquatic species and habitat less than alternative E but significantly more that Alternatives C, F, and G. Alternatives F and G are similar and present substantial decreases in the relative risk to aquatic species and habitat, Alternative G presents a slight decrease in the relative risk when compared to Alternative F. When the action alternatives are compared Alternative C presents the greatest relative risk to aquatic species and habitat.

## Motorized Dispersed Camping

Motorized dispersed camping currently occurs across the entire forest landscape excluding areas within wilderness, research natural areas (RNA), and off road vehicle restricted (OHV) areas. Motorized dispersed camping is currently limited by terrain features, vegetation, and other conditions that limit accessibility with motorized vehicles. Motorized dispersed camping may impact aquatic habitat and species in areas that are available for the activity and where streams are within the corridors. Riparian areas along streams are favored camping areas and the potential exists for motorized dispersed camping to impact riparian vegetation, increase available sediment, and cause stream bank disturbance in camping corridors. Table 3.5 displays the miles of perennial and intermittent stream that is within areas available for motorized dispersed camping. The miles of streams potentially affected is significantly reduced in all of the action alternatives.

**Table 3.5---Miles of perennial and intermittent streams that are within motorized dispersed camping corridors.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| Miles of Stream Within Motorized Camping Corridors | 862* | 64 | 33 | 0 | 52 | 44 |
| Change in Miles of Stream Within Motorized Camping Corridors | | -798 | -829 | -862 | -810 | -818 |

*Includes all miles of perennial and intermittent streams that are not located within wilderness, RNAs, ORVs and, that because the Forest is currently open to cross country travel could be impacted, assuming they are accessible, by motorized dispersed camping.

Alternative E does not include motorized dispersed camping corridors and presents the lowest relative risk from motorized dispersed camping to aquatic species and habitat. Alternative B includes the highest relative risk because the entire forest, excluding wilderness, RNAs, and ORVs, is open to motorized cross country travel which allows dispersed camping anywhere that is accessible. Alternatives F and G are similar and present less relative risk to aquatic species and habitat then Alternatives B and C but more than Alternatives E and D.

### Motorized Big Game Retrieval

Motorized big game retrieval currently occurs across the entire forest landscape excluding areas within wilderness, research natural areas (RNA), and off road vehicle restricted (OHV) areas. Motorized big game retrieval is currently limited in some areas by terrain features, vegetation, and other conditions that limit accessibility with motorized vehicles. Table 3.6 displays the miles of perennial and intermittent stream that are within areas available for motorized big game retrieval. The miles of streams potentially affected are significantly reduced in all of the action alternatives.

**Table 3.6---Miles of perennial and intermittent stream within areas available for motorized big game retrieval.**

| | **Alt. B** | **Alt. C** | **Alt. D** | **Alt. E** | **Alt. F** | **Alt. G** |
|---|---|---|---|---|---|---|
| Miles of perennial and intermittent stream in areas available for motorized big game retrieval | 862 | 672 | 33 | 0 | 469 | 44 |
| Change in miles of stream in areas available for motorized big game retrieval | | -190 | -829 | -862 | -393 | -818 |

Alternative E presents the lowest relative risk to aquatic habitat and species from motorized big game retrieval. Alternative B includes the most miles of perennial and intermittent streams that could potentially be affected by motorized big game retrieval and presents the highest relative risk. Alternative

C presents reduced relative risk when compared to Alternative B. However, Alternative C presents the highest level of relative risk of any action alternative. Alternatives D, E, and G are similar with Alternative D presenting a greater reduction in relative risk when the three are compared. Alternative F presents a greater relative risk to aquatic habitat and species than Alternatives D, E, and G.

### Motorized Areas

Motorized areas include thirty-eight traditional camping sites located along or at the terminus of forest roads and one area (3.31 acres) on the Reserve Ranger District that is proposed as an all terrain vehicle play area. Alternatives D and E do not include any of the areas. Alternatives C, F, and G include all of the areas. These areas are already being utilized for motorized camping or recreation under Alternative B which also allows cross country motorized travel across the entire forest excluding wilderness, RNAs, and ORV areas. Alternative B presents the highest level of relative risk due to the potential for cross country travel to affect aquatic habitat and species. Alternatives D and E present the lowest level of relative risk due to no areas being proposed as open to motorized use. Alternatives C, F, and G include 0.03 miles of perennial or intermittent stream within one of these areas that may be impacted by motorized use.

## Individual Species Analysis

### Endangered and Threatened Species and Designated Critical Habitat

Table 3.7 below lists U.S. Fish and Wildlife Service endangered, threatened, and candidate aquatic species and designated critical habitat that occur in project area.

**Table 3.7 Federally listed aquatic species.**

| *Species (common name)* | *Status* |
|---|---|
| Loach minnow | Threatened with Critical Habitat |
| Spikedace | Threatened with Critical Habitat |
| Gila chub | Endangered with Critical Habitat |
| Chihuahua chub | Threatened |
| Gila trout | Threatened, MIS |

### Loach Minnow (Threatened)

The loach minnow is a small, slender, elongate fish rarely exceeding 60 mm (2.4 in) long, with eyes that are directed upward and a terminal mouth that has no barbels (Minckley 1973). Loach minnow have an olivaceous coloration that is highly blotched with darker pigment; whitish spots are present at the origin and insertion of the dorsal fin as well as the dorsal and ventral portions of the caudal fin base. Breeding males develop bright red-orange coloration at the bases of the paired fins, on adjacent fins, on the base of the caudal opening, and often on the abdomen. Breeding females become yellowish in color on their fins and lower body (Minckley 1973; Sublette *et al*. 1990).

The loach minnow is found in turbulent, rocky riffles of rivers and tributaries from 709 m (2,325 ft) up to about 2,513 m (8,240 ft) in elevation. Loach minnow are bottom-dwelling inhabitants of shallow, swift waters flowing over gravel, cobble, and rubble substrates in mainstream rivers and tributaries (Rinne 1989; Propst and Bestgen 1991). They use the spaces between, and in the lee of larger substrates for resting and spawning (Propst 1999; Rinne 1989). The species is rare or absent from habitats where fine sediments fill the interstitial spaces (Propst and Bestgen 1991). They are opportunistic benthic insectivores, feeding primarily on riffle-dwelling larval mayflies (Ephemeroptera), blackflies (Simulidae), and midges (Chironomidae) (Propst 1999). They actively seek their food on bottom substrates, rather than pursuing food items in the drift (Arizona Game and Fish Department 2002).

Critical habitat was designated and the primary constituent elements for loach minnow were developed. These elements include "permanent, flowing, unpolluted water; living areas for loach minnow adults, juveniles, and larvae with appropriate flow regimes and substrates; spawning areas; low amounts of fine sediment and substrate embeddedness; riffle, run, and backwater components; low to moderate stream gradients; appropriate water temperatures; periodic natural flooding; an unregulated hydrograph, or, if flows are modified, a hydrograph that demonstrates an ability to support a native fish community; and, habitat devoid of non-native aquatic species detrimental to loach minnow, or habitat where such nonnative species are at levels which allow persistence of loach minnow" (U. S. Fish and Wildlife Service 2007).

The loach minnow is endemic to the Gila River basin of Arizona and New Mexico, and Sonora, Mexico. Its historic range included the basins of the Verde, Salt, San Pedro, San Francisco, and Gila rivers (Minckley 1973; Sublette *et al*. 1990). The species is believed to be extirpated from Mexico. During the last century, both the distribution and abundance of the loach minnow have been greatly reduced throughout its range (Propst *1999*). Extant populations are geographically isolated and inhabit the upstream reaches of their historic range.

In New Mexico, the loach minnow historically occupied about 330 stream km (205 mi); now it is found in about 258 stream km (160 mi). The loach minnow has become very rare in substantial portions of this remaining range. The species is extant in the upper Gila River, including the East, Middle, and West forks, the San Francisco and Tularosa rivers, and Dry Blue Creek.

The status of loach minnow is declining range wide. Although it is currently listed as threatened (U. S. Fish and Wildlife Service 1986), the U.S. Fish and

Wildlife Service found that a petition to list the species as endangered is warranted. A reclassification proposal is pending because work is precluded due to higher priority listing actions (U.S. Fish and Wildlife Service 1994b). During the last century, both the distribution and abundance of the loach minnow have been greatly reduced throughout the species' range (Propst *et al*. 1988).

The first spawn of loach minnow generally occurs in their second year, primarily from March through May (Propst *et al*. 1988). Spawning occurs in the same riffles occupied by adults during the non-spawning season (Propst *1999*). The adhesive eggs of the loach minnow are attached under the downstream side of a rock that forms the roof of a small cavity in the substrate (Propst *1999*). The number of eggs per rock ranges from 5 to more than 250, but is usually between 52 and 63 (Propst *et al*. 1988). Limited data indicate that the male loach minnow may guard the nest during incubation (Propst *et al*. 1988).

Both historic and present landscapes surrounding loach minnow habitats have been impacted to varying degrees by domestic livestock grazing, mining, agriculture, timber harvest, recreation, development, or impoundments (Propst et al. 1988; USFWS 1990). These activities degrade loach minnow habitats by altering flow regimes, increasing watershed and channel erosion and thus sedimentation, and adding contaminants to streams and rivers. As a result, these activities may affect loach minnow through direct mortality, interference with reproduction, and reduction of invertebrate food supplies.

Competition with non-native fishes is often cited as a major factor in the decline of loach minnow (Propst 1999). The red shiner, in particular, is frequently indicated in the decline of this fish (Minckley 1973). Channel catfish (*Ictalurus punctatus*) and flathead catfish (*Pylodictis olivaris*) frequent riffles occupied by loach minnow, especially at night when catfish move into these areas to feed. Largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui)*, green sunfish (*Lepomis cyanellus*), and introduced trout (Salmonidae) may co-occur and prey on loach minnow. These non-native fish may also impact loach minnow populations through competition for food and space.

**Comparison of Alternatives**

Motorized routes can have both direct and indirect effects on loach minnow and designated critical habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.8 displays the miles of NFS motorized routes within 300 feet of loach minnow critical habitat for each alternative.

**Table 3.8---Miles of NFS motorized routes within 300' of loach minnow designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 24 | 14 | 5 | 4 | 13 | 6 |
| **Miles of Administrative Road** | 0 | 10 | 12 | 12 | 11 | 11 |
| **Motorized Trail < 50"** | 2 | 2 | 1 | 0 | 1 | 1 |
| **Total Miles of Motorized Routes** | 26 | 26 | 18 | 16 | 25 | 18 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -31% | -38% | -4% | -31% |

Alternative B and C have the greatest length of motorized routes within 300 feet of loach minnow critical habitat, followed by Alternative F, and Alternative G, respectively. When compared to Alternative B, Alternatives E, D, and G reduce the miles of road within 300' of loach minnow critical habitat by 38%, 31%, and 31% respectively. Alternative E has the fewest miles of motorized routes within 300 feet of critical habitat and presents the lowest relative risk to loach minnow and critical habitat related to the impacts from motorized routes. The relative risk to aquatic habitat and species is greatest from Alternatives B, C, and F.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route-stream crossings can: a) indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation; b) can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows; and c) cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.9 displays the number of motorized route crossings within designated critical habitat for the loach minnow.

**Table 3.9---Number of stream crossings in loach minnow designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 75 | 44 | 5 | 5 | 41 | 8 |
| **Low Water Administrative Road** | 0 | 31 | 39 | 39 | 37 | 37 |
| **Low Water Motorized Trail <50"** | 4 | 4 | 0 | 0 | 1 | 1 |
| **Bridge** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Culvert** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total Number of Crossings** | 81 | 81 | 46 | 46 | 81 | 48 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | 0% | -43% | -43% | 0% | -41% |

Alternatives B, C, and F have the greatest number of stream and river crossings in loach minnow critical habitat.   There is no change in the number of crossings in Alternatives C and F from the no action alternative.  However, both Alternative C and F reduce substantially the number of motorized crossings that are open to the public and all vehicle types.  When compared to Alternative B, Alternatives E and D both reduce stream and river crossings by 43% and present  the lowest relative risk to aquatic species and habitat related to the impacts from NFS motorized route stream crossings.  The relative risk to aquatic habitat and species is greatest from Alternatives B, C, and F.  Alternative G is similar to Alternatives D and E but includes more route crossings in loach minnow critical habitat that are motorized to all users and vehicle types.  Alternatives D and E do not include any motorized trail crossings and Alternatives F and G substantially decrease the number of motorized trail crossings.

### Spikedace (Threatened)

Adult spikedace are 63-75 mm (2.5-3.0 in) long (Sublette *et al.* 1990).  The eyes are large, the snout fairly pointed, and the mouth is slightly sub-terminal with no barbells present.  The species is slender, somewhat compressed anteriorly.  Scales are present only as small deeply embedded plates.  The first spinous ray of the dorsal fin is the strongest and most sharp-pointed. Spikedace are olive-gray to light brown above with brilliant silver sides and black specks and blotches on the back and upper side.  Breeding males have bright brassy yellow heads and fin bases, with yellow bellies and fins (Minckley 1973).  Spikedace can live up to 24 months, although few survive more than 13 months (Propst *et al.* 1986).  Reproduction occurs primarily in one-year-old fish (Propst *et al.* 1986).

Spikedace occupy mid-water habitats usually less than 1 m deep, with slow to moderate water velocities over sand, gravel, or cobble substrates (Propst *et al*. 1986).  Adults often aggregate in shear zones along gravel-sand bars where rapid water borders slower flow, quiet eddies on the downstream edges of riffles, and broad shallow areas above gravel-sand bars (Propst *et al*. 1986). The preferred habitat of the spikedace varies seasonally and with maturation (Propst *et al*. 1986). In winter, the species congregates along stream margins with cobble substrates. The erratic flow patterns of southwestern streams that include periodic spates and recurrent flooding are essential to the feeding and reproduction of the spikedace by scouring the sands and keeping gravels clean (Propst *et al.* 1986). Spikedace larvae and juveniles tend to occupy shallow, peripheral portions of streams that have slow currents and sand or fine gravel substrates, but will also occupy backwater habitats (Sublette *et al.* 1990). The young typically occupy stream margin habitats, where the water velocity is less than 8 cm/sec (0.26 ft/sec) and the depth is less than 30 cm (0.98 ft; Propst 1999).

Spikedace feed primarily on aquatic and terrestrial insects (Barber and Minckley 1983, Propst *et al*. 1986). Diet composition is largely determined by type of habitat and time of year (Minckley 1973).

The FWS determined the primary constituent elements for spikedace to include those habitat features required for the physiological, behavioral, and ecological needs of the species (U. S. Fish and Wildlife Service 2000). For spikedace, these include: "permanent, flowing, unpolluted water; living areas for spikedace adults, juveniles, and larvae with appropriate flow regimes and substrates; spawning areas; low amounts of fine sediment and substrate embeddedness; riffle, run, and backwater components; low to moderate stream gradients; appropriate water temperatures; periodic natural flooding; an unregulated hydrograph, or, if flows are modified, a hydrograph that demonstrates an ability to support a native fish community; and, habitat devoid of non-native aquatic species detrimental to loach minnow, or habitat where such nonnative species are at levels which allow persistence of spikedace" (U. S. Fish and Wildlife Service 2002).

The spikedace is native to the Gila River drainage, including the San Francisco drainage, except in the extreme headwaters (Propst *et al.* 1986). The spikedace currently persists only in the upper Verde River and Aravaipa Creek in Arizona and portions of the Gila River in New Mexico (Minckley 1973, Bestgen 1985, Sublette *et al.* 1990). Spikedace have not been collected in the Verde River in recent years, but survey efforts have not been thorough. The species is generally absent from the Gila River from the confluence of the West and East Forks downstream to the mouth of Turkey Creek, and occurs irregularly downstream from the mouth of the Middle Box of the Gila River to the Arizona/New Mexico state line (Propst *et al.* 1986).

Since the 1800s, the spikedace has declined markedly in distribution and abundance throughout its range (Propst *et al.* 1986, U.S. Fish and Wildlife Service 1986). By 1996, the spikedace had been eliminated from over 85% of its historic range. Recent taxonomic and genetic work on spikedace, indicate there are substantial differences in morphology and genetic composition among remnant spikedace populations.

Spawning extends from mid-March into June and occurs in shallow (less than 15 cm [5.9 in] deep) riffles with gravel and sand bottoms and moderate flow (Propst *et al.* 1986). By mid-May, most spawning has occurred, although in years of high water flows, spawning may continue into late May or early June (Propst *et al.* 1986). Reproduction is apparently initiated in response to a combination of declining stream discharge and increasing water temperature. The ova are adhesive and demersal and adhere to the substrate. The number of eggs produced varies from 100 to over 800, depending on the size of the individual (Minckley 1973, Propst *et al.* 1986). The young grow rapidly, attaining a length of 38 mm (1.5 in) by autumn of the year spawned (Propst 1999).

Distribution and abundance of spikedace has declined due to riparian degradation, water diversion, and groundwater pumping. Introduction and spread of non-native predatory and competitive fishes also contributed to its decline. Resource activities that affect water quality, such as removal of riparian vegetation, sedimentation, or control of water levels, can affect spikedace habitat quality.



### Comparison of Alternatives

Motorized routes can have both direct and indirect effects on spikedace and designated critical habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.10 displays the miles of NFS motorized routes within 300 feet of spikedace critical habitat for each alternative

**Table 3.10---Miles of NFS motorized routes within 300' of spikedace designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 5 | 3 | 2 | 2 | 2 | 2 |
| **Miles of Administrative Road** | 0 | 2 | 2 | 2 | 2 | 2 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 5 | 5 | 4 | 4 | 4 | 4 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -20% | -20% | -20% | -20% |

Alternatives B and C have the greatest number of miles of NFS motorized routes within 300 feet of spikedace critical habitat. All of the action alternatives, except Alternative C, decrease the miles of motorized routes within critical habitat for the spikedace. The miles of motorized routes within 300 feet of spikedace critical habitat is relatively the same for all action alternatives. Alternatives D, E, F, and G are similar. Alternative C presents slightly less relative risk to spikedace and designated critical habitat than Alternative B due to two miles of route becoming single purpose and the subsequent reduced use on those miles of route.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.11 displays the number of motorized route crossings within designated critical habitat for the spikedace.

**Table 3.11---Number of stream crossings in spikedace designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 11 | 3 | 3 | 1 | 3 | 3 |
| **Low Water Administrative Road** | 0 | 8 | 8 | 10 | 8 | 8 |
| **Low Water Motorized Trail <50”** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bridge** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Culvert** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total Number of Crossings** | 13 | 13 | 13 | 13 | 13 | 13 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | 0% | 0% | 0% | 0% | 0% |

The number of crossings within spikedace critical habitat is the same for all alternatives. Alternative E presents the lowest relative risk to spikedace and designated critical habitat due to eight stream crossing on routes that are proposed to become single purpose routes. Alternatives C, D, F, and G are idintical and present increased relative risk when compared to Alternative E but decreased relative risk when compared to Alternative B. The decreased relative risk is due to some routes being proposed as single purpose routes and the reduced use associated with this status.

**Gila Chub (Endangered)**
The Gila chub is a moderately-sized, deep-bodied, darkly-colored cyprinid that typically attains a size of 150 mm (5.9 in) total length; females may exceed 200 mm (7.88 in) in length (Minckley 1973; Propst 1999; and Weedman et al. 1996).

Gila chub commonly inhabit pools in smaller streams, springs, and cienegas, and can survive in small artificial impoundments (Minckley 1973; Rinne 1975). Gila chub are highly secretive, preferring quiet, deeper waters, especially pools, or remaining near cover including terrestrial vegetation, boulders, and fallen logs (Rinne and Minckley 1991). Undercut banks created by overhanging terrestrial vegetation with dense roots growing into pool edges provide ideal cover (Nelson 1993). Gila chub can survive in larger stream habitat such as the San Carlos River and artificial habitats like the Buckeye Canal (Stout et al. 1970). Gila chub interact with spring and small stream fishes regularly (Meffe 1985), but adults are usually restricted to deeper waters (Minckley 1973). They are often found in deep pools and eddies below areas with swift current, as in the Gila chub habitats found in Bass Canyon and Hot Springs in the Muleshoe Preserve area along the western slopes of the Galiuro Mountains. Young-of-the-year inhabit shallow water among plants or eddies, while older juveniles use higher velocity stream areas and then retire to pools when adults (Minckley 1973).

The specific biological and physical features, otherwise referred to as the PCEs, proposed as essential to the conservation of the Gila chub include, but are not limited to, the habitat components that provide: (1) perennial pools, areas of higher velocity between pool areas, and areas of shallow water among plants or eddies all found in small segments of headwaters, springs, or cienegas of smaller tributaries, (2) water temperatures for spawning ranging from 20 to 26.5ºC (68 to 79.7ºF) with sufficient dissolved oxygen, nutrients, and any other water-related characteristic needed, (3) water quality with reduced levels of contaminants or any other water quality characteristics, including excessive levels of sediments, adverse to Gila chub health, (4) a food base consisting of invertebrates, filamentous algae, and insects; (5) sufficient cover consisting of downed logs in the water channel, submerged large tree root wads, undercut banks with sufficient overhanging vegetation, and large rocks and boulders with overhangs; (6) habitat devoid of non-native aquatic species detrimental to Gila chub or habitat in which detrimental non-natives are kept at a level that allows Gila chub to continue to survive and reproduce; and (7) streams that maintain a natural unregulated flow pattern including periodic natural flooding; if flows are modified, then the stream should retain a natural flow pattern that demonstrates an ability to support Gila chub (U. S. Fish and Wildlife Service 2002).

In stable, spring-fed systems, reproduction of Gila chub may take place from late winter to early autumn, but the peak season in other areas occurs during late spring and summer (Minckley 1973). Most Gila chub become sexually mature in their second or third year (Griffith and Tiersch 1989). Optimal water temperature for spawning appears to be between 20 and 24°C (Griffith and Tiersch 1989). Spawning may occur over beds of aquatic plants (Minckley 1973).

Historically, the Gila chub was found in approximately 30 headwater streams of the Gila River basin in Arizona and New Mexico, and within the Santa Cruz and San Pedro River systems of Arizona and Sonora, Mexico (Miller and Lowe 1967; Rinne 1994; Minckley 1973; Bestgen and Propst 1989). The Gila chub is currently restricted to small isolated populations scattered throughout its historical range. Currently, it is thought to occur in Turkey Creek on the Gila National Forest in New Mexico. In Sonora, it was recently found in two cienegas near the headwaters of the San Pedro River. In Arizona, populations have been extirpated from Monkey Spring; Arnett, Cave, Fish, and Queen Creeks; San Simon, San Pedro, and Santa Cruz Rivers; and Post Canyon. Gila Chub are found in fewer than 15 streams in central and southern Arizona and are abundant at no more than 10 of these locations.

Eighty-five to 90 percent of Gila chub habitat has been degraded or destroyed, and much of it is unrecoverable (USFWS 2005). Only 29 extant populations of Gila chub remain; all but one is small, isolated, and threatened. The current status of the Gila chub is poor and declining. Fifty-nine percent of the land supporting all of the extant populations occurs on BLM and Forest Service lands. Other ownership includes the San Carlos Apache Indian Tribe, Arizona State Land Department, the Audubon Society, The Nature Conservancy, and multiple private landowners.

Where Gila chub is still present, populations are often small, scattered, and at risk from known and potential threats and from random events. Continued degradation of habitat and non-native species are considered the major threats to Gila chub. The decline of this fish is due to habitat loss and invasion of nonindigenous fish species. Habitat loss has included past and current dewatering of rivers, springs, and cienegas; diversion of water channels; impoundments; regulation of flow; and land management practices. All of these activities have promoted erosion and arroyo formation and the introduction of predacious and competing nonindigenous fish species (Miller 1961).

**Comparison of Alternatives**

Motorized routes can have both direct and indirect effects on Gila chub and designated critical habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.12 displays the miles of NFS motorized routes within 300 feet of Gila chub critical habitat for each alternative.

Primary constituent elements of critical habitat include perennial water that is of the correct temperature for all life stages, water quality that supports the species, sufficient food base and cover, and is devoid of nonnative species that are detrimental to Gila chub. All alternatives include motorized routes that are within 300 feet of Gila chub critical habitat in Harden Cienega and Turkey Creeks. However, the majority of designated critical habitat on the Gila National Forest lacks most of these primary constituent elements including perennial water. The designated critical habitat, on the Forest, that does have these elements present is located in the Gila Wilderness where there are no roads.

**Table 3.12---Miles of NFS motorized routes within 300' of Gila chub designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 4 | 4 | 2 | 2 | 2 | 2 |
| **Miles of Administrative Road** | 0 | 0 | 1 | 1 | 1 | 1 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 4 | 4 | 3 | 3 | 3 | 3 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -25% | -25% | -25% | -25% |

Alternatives B and C have the greatest miles of motorized routes within 300 feet of Gila chub critical habitat and presents the greatest relative risk to the species. The miles of motorized routes within 300 feet of Gila chub critical habitat is the same for alternatives D, E, F, and G.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.13 displays the number of motorized route crossings within designated critical habitat for the Gila chub.

**Table 3.13---Number of stream crossings in Gila chub designated critical habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 5 | 5 | 3 | 2 | 3 | 3 |
| **Low Water Administrative Road** | 0 | 1 | 1 | 1 | 1 | 1 |
| **Low Water Motorized Trail <50”** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bridge** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Culvert** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Number of Crossings** | 5 | 6 | 4 | 3 | 4 | 4 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | +20% | -20% | -40% | -20% | -20% |

The number of crossings within Gila chub critical habitat is the same for Alternatives D, F, and G and when compared to the no action alternative, they all present a slight decrease in the relative risk to Gila chub. Alternative C includes the greatest number of crossings and presents the greatest relative risk to the Gila Chub. Alternative E has the fewest number of crossings and presents the lowest relative risk to Gila chub.



## Chihuahua Chub (Threatened)

The Chihuahua chub is a medium-sized fish of the minnow family (*Cyprinidae*) that may exceed 250 mm (9.8 in) total length and is mottled dark slate-gray to dark olive green dorsally, gray laterally, and cream to white ventrally (Propst 1999). Reproductive adults are orange-reddish around the base of paired-fins, around the mouth, and ventrally, with the males typically being more intensely colored and containing numerous small nuptial tubercles on the head (Propst 1999). It is described as an opportunistic carnivore in its feeding behavior taking terrestrial insects, aquatic invertebrates, and some fish and vegetation (Sublette *et al.* 1990).

Chihuahua chub require habitat comprised of deep pools associated with undercut banks (Sublette *et al.* 1990) or overhanging vegetation which provides cover and foraging habitat (U. S. Fish and Wildlife Service 1986). Occupied pools are 1-2 meters (3.28-6.56 ft) deep with water velocity ≤ 15 cm/sec (0.49 ft/sec) (Propst 1999). The pools are located immediately adjacent to runs with flows ≥ 60 cm/sec (1.97 ft/sec) and downstream from cobble-bottomed riffles (Propst 1999). Substrate in the pools occupied by Chihuahua chub is typically pea-gravel and sand (Propst 1999).

Propst and Stefferud (1994) suggest that the spawning season could extend from early spring through autumn across the Chihuahua chub's range. In New

Mexico, spawning probably occurs from spring to summer, eggs are probably scattered randomly over sandy or silt substrates, and young most likely occupy quiet backwaters (New Mexico Department of Game and Fish 1988). Chihuahua chub in captivity mature at age two or three (Propst 1999). Wild fish probably do not live more than four or five years (Propst and Stefferud 1994).

The Chihuahua chub is restricted to the closed Guzman Basin of southwestern New Mexico and northwestern Chihuahua, Mexico (Miller and Chernoff 1979), and the Laguna Bustillos basin in Chihuahua, Mexico (Miller and Chernoff 1979). In New Mexico, Chihuahua chub is only native to the Mimbres River drainage (Sublette *et al.* 1990).

In 1975, a small reproducing population was found in Moreno Spring (Propst 1999). Moreno Spring is located off NFS lands along the Mimbres River, Grant County, New Mexico. Chihuahua chub are reported to occur regularly at Moreno Spring, and irregularly along an approximate 15 km (9.3 mi) reach of the Mimbres River from Allie Canyon southward to the NMDGF property south of Mimbres, New Mexico (Propst 1999). Chihuahua chub were stocked into McKnight Creek, a Mimbres River tributary, by NMDGF, USFWS, and Forest Service. Reproduction in McKnight Creek was not confirmed and recent surveys indicate that the species is no longer present in the creek. During 2008 stream surveys Chihuahua chub were collected from a reach of Mimbres River within the Gila National Forest (J.Monzingo, Pers. Obs.). This site is approximately eleven miles upstream of known occupied habitat.

Populations range-wide appear to be decreasing, particularly in Mexico (Propst 1994). Propst (1999) reports Chihuahua chub numbers are typically less than 300 around Moreno Spring. Sublette *et al.* (1990) report the status of the population as "diminishing". However, D. Propst (D. Propst personal communication) believes the population has remained stable at 200-300 individuals in the recent past. Historically, Chihuahua chub probably occupied all the warmwater reaches of the Mimbres River drainage (Propst 1999).

Habitat modification or loss appears to have played a major part in the decline of the Chihuahua chub. Improper grazing, irrigation diversion, stream modification (e.g. channelization, levees, etc.), and degraded watershed conditions that caused severe flooding and loss of riparian vegetation have been identified as causes for the loss of habitat (U. S. Fish and Wildlife Service, 1986).

Introduced non-native species have been reported to prey on Chihuahua chub and/or have been reported to take over preferred habitats (Sublette *et al.* 1990, Propst 1999).

### Comparison of Alternatives

Motorized routes can have both direct and indirect effects on Chihuahua chub and its' habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.14 displays the miles of NFS motorized routes within 300 feet of Chihuahua chub occupied habitat.

**Table 3.14---Miles of NFS motorized routes within 300' of occupied Chihuahua chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Roads** | 2 | 1 | 1 | 0 | 1 | 1 |
| **Miles of Administrative Roads** | 0 | 0 | 0 | 1 | 0 | 0 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 2 | 1 | 1 | 1 | 1 | 1 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | -50% | -50% | -50% | -50% | -50% |

Alternative B includes the highest number of miles of motorized routes in occupied Chihuahua chub habitat and therefore presents the greatest relative risk to the species. All of the action alternatives reduce the miles of routes in occupied habitat. However, Alternative E reduces the relative risk further by designating as single purpose the routes that are within occupied habitat, therefore reducing use.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.15 displays the number of motorized route crossings within occupied Chihuahua chub habitat.

**Table 3.15---Number of NFS route-stream crossings in occupied Chihuahua chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 17 | 2 | 2 | 0 | 2 | 2 |
| **Low Water Administrative Road** | 0 | 0 | 0 | 2 | 0 | 0 |
| **Total Number of Crossings** | 17 | 2 | 2 | 2 | 2 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | -88% | -88% | -88% | -88% | -88% |

Alternative B includes the highest number of stream crossing in occupied Chihuahua chub habitat and therefore presents the greatest relative risk to the species. All of the action alternatives reduce the number of stream crossings in occupied habitat. However, Alternative E reduces the relative risk further by designating as single purpose the routes and thus the crossings that are within occupied habitat, therefore reducing use.

### Gila Trout (Threatened)

Gila trout (*Oncorhynchus gilae*) is a moderate-sized salmonid that typically attains lengths of 20-25 cm (8-10 in); older individuals can exceed 35.5 cm (14 in) in total length. Gila trout are deepbodied, with fine, profuse black spotting on their body, and dorsal and adipose fins. Adults are golden to greenish-yellow in color. Dorsal, anal, and pelvic fins are edged in white. The golden coloration of the body, parr marks, and fine, profuse spots above the lateral line distinguish Gila trout from other co-occurring non-native trout species in the field (U.S. Fish and Wildlife Service 2003).

Gila trout are a typical cold-water species requiring well-oxygenated water; coarse sand, gravel, and cobble substrate; stable stream bank conditions; and abundant overhanging banks, pools, and cover for optimal habitat. They are found in moderate to high gradient (from 1 percent to over 14 percent gradient) perennial streams above 5400 feet (1660 m) to over 9200 ft (2838 m) in elevation (McHenry 1986, Propst and Stefferud 1997). The species requires water temperatures below 77°F (25°C), adequate stream flow to maintain survivable conditions, and clean gravel substrates for spawning (U.S. Fish and Wildlife Service 2003).

Stream flow in Gila trout habitat is characterized by a snowmelt dominated hydrograph. Snowmelt runoff typically begins in February, peaks in March, and gradually decreases in May, with base flow conditions continuing in June and into July. Convectional summer thunderstorms increase the mean monthly discharges characteristically found in July through September.

Over wintering habitat, or habitat that provides shelter during periods of minimal water temperatures between November and February, generally consists of deep pools with cover such as boulders or root wads, or deep beaver ponds. Access to larger mainstem habitats from headwater streams may be an important function of over-winter survival where perennial surface water connection between streams exists (U.S. Fish and Wildlife Service 2003).

Spawning begins when temperatures reach about 47°F (8°C), but day length may also be an important trigger. Stream flow is apparently of secondary importance in triggering spawning. Spawning begins in early April at the lowest elevations and continues through June at the highest elevations. Gila trout use substrates of fine gravel and coarse sand (0.07-1.5 in; 0.8-3.8 cm) during spawning (Rinne 1980). Redd size varies from less than 1.1 to 21.5 ft2 (0.1 to 2.0 m2). Spawning activity typically occurs between 1300 to 1600 hours. Rinne (1980) noted one pair of fish normally occurred over a redd and spawning behavior was typical of other salmonids. Fry emerge from redds in 56 to 70 days at 0.8 to 1.0 inches (2.0 to 2.54 cm) total length (Rinne 1980). They attain a length of 2.7 to 3.5 inches (6.9 to 8.9 cm) by the end of their first summer at lower elevations, and 1.6 to 2.0 inches (4.04 to 5.08 cm) at higher elevations (Rinne 1980, Turner 1986). Gila trout generally reach 7.1 to 8.7 inches (18 to 22.1 cm) total length by the end of the third growing season except in the highest elevation streams. Females may reach maturity between age 2 and 5 (U.S. Fish and Wildlife Service 2003), with a minimum length of 5 inches (130 mm) reported for mature fish. Most individuals are mature at a length of 150 mm (6 inches) or greater (U.S. Fish and Wildlife Service 2003). Males typically reach maturity at age two or three.

Historically, Gila trout were believed to occupy the upper Gila in New Mexico and parts of the San Francisco systems of Arizona and New Mexico (Behnke 2002). The Arizona populations were believed to be extirpated around the turn of the 20th century (U.S. Fish and Wildlife Service 1993). The New Mexico populations were depleted to five populations in the headwaters of the Gila drainage by the 1960's (Minckley 1973, Propst and Stefferud 1997). Distribution of both Gila and Apache trout is not known for certain, but Behnke (20**0**2) theorizes that Gila and Apache trout may have come together in the Verde River during the last glacial period to hybridize and produce a form intermediate to the two still existing trout. By the 1960's the Gila trout range had been severely fragmented into small isolated populations in five headwater streams: Main Diamond, South Diamond, McKenna, Spruce, and Iron Creeks (U.S. Fish and Wildlife Service 1993). Beginning in 1970, Gila trout from each of the five relict populations were translocated into other streams. Iron Creek and McKenna fish were later found to be hybridized with rainbow trout (Riddle et al. 1998). In 1992, a relict population in Whiskey Creek was discovered. There are now four relict lineages: Main Diamond, South Diamond, Spruce Creek, and Whiskey Creek.

Currently there are 15 populations of Gila trout in the wild. Of the four relict populations (Main Diamond, South Diamond, Spruce, and Whiskey Creek), only Main Diamond, South Diamond and Spruce are secure. Whiskey Creek is no longer considered a viable replicated population due to the fires of 2003. The total population size in 1998 was estimated to be approximately 37,000 fish (U.S. Fish and Wildlife Service 2003) and approximately 62 miles (100 km) of stream were occupied in June 2000 (U.S. Fish and Wildlife Service 2003).

Major threats to this species include habitat alterations, competition, hybridization and predation by non-indigenous fish.

### Comparison of Alternatives

Motorized routes can have both direct and indirect effects on Gila trout and its' habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.16 displays the miles of NFS motorized routes within 300 feet of occupied Gila trout habitat.

**Table 3.16---Miles of NFS motorized routes within 300' of occupied Gila trout habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 1.30 | 1.10 | 1.10 | 1.00 | 1.10 | 1.10 |
| **Miles of Administrative Road** | 0 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 1.30 | 1.30 | 1.30 | 1.20 | 1.30 | 1.30 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | 0% | 0% | 0% | -8% | 0% | 0% |

Alternative B includes the highest number of miles of motorized routes open to all users in occupied Chihuahua chub habitat and therefore presents the greatest relative risk to the species. Alternative E is the only action alternative that reduces the miles of routes within occupied habitat and presents the lowest relative risk. Alternatives C, D, F, and G are the same and reduce relative risk when compared to Alternative B due to reduced use on 0.20 miles of route proposed as single purpose route. These alternatives present a slightly higher relative risk than Alternative E due to a tenth of a mile more of motorized route.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.17 displays the number of motorized route crossings within occupied Gila trout habitat.

**Table 3.17---Number of stream crossings in occupied Gila trout habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 2 | 1 | 1 | 1 | 1 | 1 |
| **Low Water Administrative Road** | 0 | 1 | 1 | 1 | 1 | 1 |
| **Low Water Motorized Trail <50”** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bridge** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Culvert** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Number of Crossings** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | 0% | 0% | 0% | 0% | 0% |

All of the action alternatives are the same and present a decrease in relative risk to occupied Gila trout habitat when compared to Alternative B due to one stream crossing being proposed as single purpose thus reducing use. Alternative B presents the highest relative risk to Gila trout.

Native trout are identified as Gila National Forest management indicator species. One stream, Black Canyon, occupied by Gila trout has two motorized routes within 300 feet of it with a bridge and two low water stream crossings associated with them. Black Canyon is seasonally open to fishing and is stocked with Gila trout on occasion. All of the action alternatives reduce the length of motorized route within 300 feet of the stream that is open to all users by designating a portion of the route as an administrative road for access to private property. One stream crossing along this portion of the route will also see reduced use as a result of this designation. The relative risk, to Gila trout, from motorized routes will be slightly reduced in all action alternatives. Gila trout population trends will not be affected by any of the action alternatives.

**Endangered Species Act, Section 7 Consultation Effects Determinations**

Table 3.18 below displays the effects determination for federally listed aquatic species that occur on the Gila National Forest and critical habitat for those species that it has been designated for.

Table 3.18---Gila National Forest Threatened, Endangered, and Designated Critical Habitat Effects Determinations.

| Species (Common Name) | Status | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|---|
| Loach minnow | T w/DCH | | MALAA | MALAA | MALAA | MALAA | MALAA |
| Spikedace | T w/DCH | | MALAA | MALAA | MALAA | MALAA | MALAA |
| Gila chub | E w/DCH | | MANLAA | MANLAA | MANLAA | MANLAA | MANLAA |
| Chihuahua chub | T | | MALAA | MALAA | MALAA | MALAA | MALAA |
| Gila trout | T | | MALAA | MALAA | MALAA | MALAA | MALAA |

T=Threatened, E=Endangered, DCH=Designated Critical Habitat
NE= No Effect, MANLAA=May Affect, Not Likely to Adversely Affect,
MALAA=May Affect Likely to Adversely Affect

## Southwestern Region Sensitive Species Occurring on the Gila National Forest

Table 3.19 below lists Southwestern Regional Forester's sensitive aquatic species that occur in or for which historic habitat occurs in the project area.

Table 3.19---Southwestern Region Sensitive Species Occurring on the Gila National Forest

| Species (Common Name) | Status |
|---|---|
| Rio Grande cutthroat trout | R3 Sensitive, MIS |
| Headwater chub | R3 Sensitive |
| Roundtail chub | R3 Sensitive |
| Longfin dace | R3 Sensitive |
| Sonora sucker | R3 Sensitive |
| Desert sucker | R3 Sensitive |
| Rio Grande sucker | R3 Sensitive |
| Rio Grande chub | R3 Sensitive |
| Gila Springsnail | R3 Sensitive |
| New Mexico hot springsnail | R3 Sensitive |
| **Black Range Mountainsnails**<br>*Oreohelix swopei*<br>*Oreohelix metcalfei acutidiscus*<br>*Oreohelix metcalfei metcalfei*<br>*Oreohelix pilsbryi*<br>*Oreohelixs metcalfei concentric* | |
| **Bearded Mountainsnail**<br>*Oreohelix barbata* | R3 Sensitive |
| **Subalpine Mountainsnail**<br>*Oreohelix subrudis* | |
| **Whitewater Woodlandsnail**<br>*Ashmunella danielsi* | |
| **Silver Creek Woodlandsnail** | |

*Ashmunella binneyi*
**Iron Creek Woodlandsnail**
*Ashmunella mendex*
**Dry Creek Woodlandsnails**
*Ashmunella tetradon inermis*
*Ashmunella tetradon mutator*
*Ashmunella tetradon tetradon*
*Ashmunella tetradon animorum*
**Black Range Woodlandsnails**
*Ashmunella cockerelli cockerelli*
*Ashmunella cockerilli argenticola*
*Ashmunella cockerelli perobtusa*

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## Rio Grande Cutthroat Trout

The Rio Grande cutthroat trout, one of 14 subspecies of cutthroat trout, is native to the Rio Grande, Pecos, and the Canadian river basins in New Mexico and Colorado (Behnke 2002 in USFWS 2008). Rio Grande cutthroat trout has the distinction of being the first North American trout recorded by Europeans (Behnke 2002 in USFWS 2008). Cutthroat trout subspecies are distinguished by the red to orange slashes in the throat folds beneath the lower jaw.

Most cutthroat trout are opportunistic feeders, eating both aquatic invertebrates and terrestrial insects that fall into the water (Sublette et al. 1990). Rio Grande cutthroat trout evolved with Rio Grande chub (Gila pandora), longnose dace (Rhinichthys cataractae) (all basins); Rio Grande sucker (Catastomus plebius) (Rio Grande Basin); white sucker (C. commersoni) and creek chub (Semotilus atromaculatus) (Pecos and Canadian Basins); and the southern redbelly dace (Phoxinus erythrogaster) (Canadian River Basin) (Rinne 1995). Many of these fish have either been extirpated from streams with Rio Grande cutthroat trout or are greatly reduced in number (Sublette et al. 1990; Calamusso and Rinne 1999). It is not known if they once were an important component of Rio Grande cutthroat trout diet. Other subspecies of cutthroat trout become more piscivorous (fish eating) as they mature (Sublette et al. 1990) and cutthroat trout living in lakes will prey heavily on other species of fish (Echo 1954). It is possible that native cyprinids (i.e., chubs, minnows, and dace) and suckers may have once been important prey items for Rio Grande cutthroat trout. Growth of cutthroat trout varies with water temperature and availability of food. Most populations of Rio Grande cutthroat trout are found in high elevation streams. Under these conditions growth may be relatively slow and time to maturity may take longer than is seen in subspecies that inhabit lower elevation (warmer) streams.

The historical distribution of Rio Grande cutthroat trout is not known with certainty. In general, it is assumed that Rio Grande cutthroat trout occupied all streams capable of supporting trout in the Rio Grande, Pecos, and Canadian basins (Alves et al. 2007 in USFWS 2008). The Pecos River is a tributary of the Rio Grande, so a historic connection between the two basins likely existed. Although no early museum specimens document its occurrence in the headwaters of the Canadian River, it is almost certainly native there as well (Behnke 2002 in USFWS 2008). The Canadian River, tributary to the Mississippi River, has no connection with the Rio Grande. It is possible that through headwater capture (a tributary from one watershed joins with a tributary from another) there may have been natural migration of fish between the Pecos and Canadian headwater streams. There is evidence that Rio Grande cutthroat trout may have occurred in Texas (Garrett and Matlock 1991 in USFWS 2008; Behnke 1992) and Mexico (Behnke 1992). Currently, the southernmost distribution of Rio Grande cutthroat trout occurs in Animas Creek, Sierra County, New Mexico, and Indian Creek on the Mescalero Apache Indian Reservation in Otero County, New Mexico. Distribution in the southern portion of the range is currently limited and no conservation populations exist south of Santa Fe, New Mexico.

The historic range of Rio Grande cutthroat trout has been greatly reduced over the last 150 years. Populations have been lost because of water diversions, stream drying, dams, habitat degradation, changes in hydrology, hybridization with rainbow trout, or competition with brown (Salmo trutta) and brook trout (Salvelinus fontinalis) (Pritchard and Cowley 2006).

The U.S. Fish and Wildlife Service ( 2008) determined that populations of Rio Grande cutthroat trout have been greatly reduced over the last 200 years. The range of Rio Grande cutthroat trout has contracted northward and populations are primarily restricted to high-elevation headwater streams. We attribute the decline in the distribution of Rio Grande cutthroat trout to habitat degradation and the introduction of nonnative sport fish into Rio Grande cutthroat trout habitat that began in the late 1800s. The wide distributions of rainbow trout and nonnative cutthroat trout have compromised Rio Grande cutthroat trout populations through competition, hybridization, and predation. These introduced fish have expanded and colonized new habitat and formed naturally reproducing populations that occupy the former, and in some cases current, range of Rio Grande cutthroat trout.

Typical of trout, Rio Grande cutthroat trout require several types of habitat for survival: spawning habitat, nursery or rearing habitat, adult habitat, and refugial habitat. Spawning habitat consists of clean gravel (little or no fine sediment present) that ranges between 6 to 40 millimeters (mm) (0.24-1.6 inches (in)) (NMDGF 2002). Nursery habitat is usually at the stream margins where water velocity is low and water temperature is slightly warmer. Harig and Fausch (2002) found that water temperature may play a critical role in the life history of the young-of-year cutthroat. Streams with mean daily temperature in July of less than 7.8 [deg]C (46 [deg]F) may not have successful recruitment (survival of individuals to sexual maturity and joining the reproductive population) or reproduction in most years. Adult habitat consists of pools with cover and riffles for food production and foraging. Refugial habitat in the form of large deep pools is also necessary for survival. The primary form of refugial habitat is deep pools that do not freeze in the winter and do not dry in the summer or during periods of drought. Lack of large pools may be a limiting factor in headwater streams (Harig and Fausch 2002). Refugial habitat may also be a downstream reach of stream or a connected adjacent stream that has maintained suitable habitat in spite of adverse conditions.

It is unknown if Rio Grande cutthroat trout spawn every year or if some portion of the population spawns every other year as has been recorded for westslope cutthroat trout (McIntyre and Rieman 1995). Likewise, while it is assumed that females mature at age 3, they may not spawn until age 4 or 5 as seen in westslope cutthroat trout (McIntyre and Rieman 1995). Sex ratio also is unknown with certainty, but based on field data, a ratio skewed towards more females might be expected (Pritchard and Cowley 2006). Although Yellowstone (Gresswell 1995), Bonneville (Shrank and Rahel 2004), and westslope (Bjornn and Mallet 1964; McIntyre and Rieman 1995) cutthroat trout subspecies are known to have a migratory life history phase, it is not known if Rio Grande cutthroat trout once had a migratory form when there was connectivity among watersheds.

Rio Grande cutthroat trout populations have been and continue to be impacted by habitat fragmentation and isolation, nonnative species interactions, drought, and fire (DOI 2008). Rio Grande cutthroat trout conservation populations occupy a fraction of their historical habitat, they are confined primarily to, small high-elevation streams with marginal habitat, they are highly fragmented, and the stream segments they occupy are short in length (USFWS 2008). All of these factors work to reduce gene flow between populations and reduce the ability of populations to recover from catastrophic events thus threatening their long-term persistence (USFWS 2008). A conservation agreement for the species in the states of Colorado and New Mexico was developed and signed by Southwestern and Rocky Mountain Regions of the Forest Service, New Mexico Department of Game and Fish, Colorado Division of Wildlife, U.S. Fish and Wildlife Service, Bureau of Land Management, National Park Service, New Mexico and Colorado Councils of Trout Unlimited, and Mescalero and Jicarilla Apache Nations. The overall goal of the agreement is to assure the long-term viability of RGCT throughout their historic range. Goals include maintaining current populations, managing for increased abundance, establishing new populations, preserving genetic diversity, and secure and enhance watershed conditions for the species.

**Comparison of Alternatives**

Motorized routes can have both direct and indirect effects on Rio Grande cutthroat trout (RGCT) and its' habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.20 and Table

3.21 display the miles of NFS motorized routes within 300 feet and the number of stream crossings respectively, in RGCT habitat.

**Table 3.20---Miles of NFS motorized routes within 300' of Rio Grande cutthroat trout habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 3 | 0 | 0 | 0 | 0 | 0 |
| **Miles of Administrative Road** | 0 | 3 | 3 | 3 | 3 | 3 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 3 | 3 | 3 | 3 | 3 | 3 |
| **Change in Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | 0% | 0% | 0% | 0% |

Currently there are no populations of RGCT on the Gila National Forest. Animas Creek, in the Black Range Mountains, is the only known historical occurrence of the species on the Forest. Suitable habitat in Animas Creek is located partially within the Aldo Leopold Wilderness and partially outside of wilderness. There is a motorized route, originating on private property, along Animas Creek. The current Forest roads database indicates the status of this route as open. However, since the route originates on private property and public access is not available. The route is for all purposes an administrative and private use route. All action alternatives include three miles of road within 300' of Animas Creek and fifteen stream crossings presenting the same level of relative risk to RGCT habitat as the no action alternative.

**Table 3.21---Number of stream crossings in historical Rio Grande cutthroat trout habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 15 | 0 | 0 | 0 | 0 | 0 |
| **Low Water Administrative Road** | 0 | 15 | 15 | 15 | 15 | 15 |
| **Low Water Motorized Trail <50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Number of Crossings** | 15 | 15 | 15 | 15 | 15 | 15 |
| **Change in No. of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | 0% | 0% | 0% | 0% | 0% |

Because currently there are no Rio Grande Cutthroat trout within the action area all alternatives will have no impact on the species but may impact suitable historic habitat. Relative risks to habitat will be reduced in all action alternatives due to the motorized route that exists in the one Rio Grande cutthroat stream on the Forest changing status from motorized for all users to motorized for administrative and/or by written permit. This status change will reduce the potential use levels on the route. Native trout are Gila National Forest management indicator species. For the above mentioned reasons the Rio Grande cutthroat trout will not be impacted by any of the alternatives and suitable habitat will be maintained at current levels.

Native trout are identified as Gila National Forest management indicator species. There are currently no Rio Grande cutthroat trout populations on the Forest. However, one stream, Animas Creek, is considered historical habitat for the Rio Grande cutthroat trout. There are three miles of motorized route within 300 feet of the stream and 15 stream crossing associated with the route. All action alternatives will reduce the motorized use on the route by designating it as an administrative route. Relative risk to Rio Grande cutthroat trout habitat will be reduced in all action alternatives. Habitat suitability for the species will not be affected by any of the action alternatives.

**Headwater Chub**

The headwater chub is an cyprinid fish (member of Cyprinidae, the minnow family) with streamlined body shape. Color in headwater chub is usually dark gray to brown overall, with silvery sides that often have faded lateral stripes. Headwater chub are quite similar in appearance to roundtail chub, although they are generally smaller, likely due to the smaller streams in which they occur (Minckley 1973; Sublette *et al.* 1990; Propst 1999; Voeltz 2002).

Headwater chub was first described from Ash Creek and the San Carlos River in east-central Arizona in 1874 (Cope and Yarrow 1875 in DOI 2006 ). Since the 1800s, both roundtail and headwater chub have been recognized as distinct entities, although at varying taxonomic levels (Holden and Stalnaker 1970;Rosenfeld and Wilkinson 1989;Dowling and DeMarais 1993; Douglas *et al.* 1998; Minckley and DeMarais 2000; Gerber *et al.* 2001). At present, both are recognized as distinct species, based on discrete occurrences of specific morphology (Minckley and DeMarais 2000). Both roundtail and headwater chub are recognized as species on the American Fisheries Society's most recent list of accepted common and scientific names of fishes (Nelson *et al.* 2004). Headwater chub are omnivores, consuming a wide variety of aquatic and terrestrial invertebrates, aquatic plants, and detritus.

Headwater chub occur in the middle to upper reaches of moderately-sized streams (Minckley and Demaris 2000). Bestgen and Propst (1989) examined status and life history in the Gila River drainage in New Mexico and found that headwater chubs occupied tributary and mainstem habitats in the upper Gila River at elevations of 1,325 meters (m) (4,347 feet (ft)) to 2,000 m (6,562 ft). Maximum water temperatures of headwater chub habitat varied between 20 to 27 °C, and minimum water temperatures were around 7 °C (Bestgen and Propst 1989; Barrett and Maughan 1995). Typical adult microhabitat consists of nearshore pools adjacent to swifter riffles and runs over sand and gravel substrate, with young of the year and juvenile headwater chub using smaller pools and areas with undercut banks and low current (Anderson and 1978 in Bestgen and Propst 1989; Bestgen and Propst 1989). Neve (1976) reported that the diet of headwater chub included aquatic insects, ostracods (small crustaceans), and plant material.

In the East Fork Gila River, Bestgen and Propst (1989) observed chubs spawning in May when water temperature was about 22° C (Bestgen, 1985). Spawning was in pool-riffles or in riffles immediately upstream of pools. Females do not spawn until Age 3 but males may spawn at Age 2 (Bestgen, 1985). Fecundity is size-dependent; an Age 5 female (300 mm TL) produced about 33,400 eggs (Bestgen, 1985). Spawning in Fossil Creek, Arizona occurred in spring and was observed in March in pool-riffle areas with sandy-rocky substrates (Neve 1976 in Bestgen and Propst 1989).

Populations of headwater chub are found in four separate drainage basins that are isolated from one another (the Verde River, Tonto Creek, San Carlos River, and upper Gila River). Within these four basins, there is further fragmentation and isolation of some populations (DOI 2006). The historical distribution of headwater chub in the lower Colorado River basin is poorly documented, due to the paucity of early collections and the widespread anthropogenic (manmade) changes (*i.e.*, habitat alteration and nonnative species introductions (Girmendonk and Young 1997 in DOI 2006) to aquatic ecosystems beginning in the mid 19th century. The headwater chub was historically considered common throughout its range (Minckley 1973; Holden and Stalnaker 1975; Propst 1999). Voeltz (2002), estimating historical distribution based on museum collection records, agency database searches, literature searches, and discussion with biologists, found that headwater chub likely occurred in a number of tributaries of the Verde River, most of the Tonto Creek drainage, much of the San Carlos River drainage, and parts of the upper Gila River in New Mexico (Voeltz 2002). Voeltz (2002) estimated that headwater chub historically occupied approximately 500 km (312 mi) in Arizona and New Mexico. The species currently occurs in the same areas, but has a smaller distribution. In Arizona, four tributaries of the Verde River (Fossil Creek, the East Verde River, Wet Bottom Creek, and Deadman Creek), and Tonto Creek and eight of its tributaries (Buzzard Roost, Gordon, Gun, Haigler, Horton, Marsh, Rock, Spring, and Turkey Creek), are currently occupied; and in New Mexico, in the East Fork, Middle Fork, and West Forks of the Gila River (Paroz et al., 2009; Voeltz 2002) support headwater chub. Headwater chub may still occur in parts of the San Carlos River basin; however recent survey information for these streams is unavailable (Minckley and DeMarais 2000, Voeltz 2002).

Headwater chub (as *G. robusta grahami*) was considered a threatened species by the American Fisheries Society on its list of fishes receiving legal protection and of special concern in 1987 (Johnson 1987). Since that time, declines of the headwater chub have been further noted both in the scientific peer reviewed literature (Bestgen and Propst 1989) and in State agency reports (Girmendonk and Young 1997 in DOI 2006; Brouder *et al.* 2000; Voeltz 2002).

The most comprehensive and recent of the status reports concerning headwater chub was completed by the Arizona Game and Fish Department in 2002, and peer-reviewed by Federal agency personnel, university researchers, and experts on the headwater chub (AGFD; Voeltz 2002). Voeltz (2002) considered the upper Gila River population of headwater chub as unstable-threatened due to land management activities including roads, channelization, development, grazing, mining, recreation, logging, water use, fire and the introduction of nonnative species.

Within the historical range of the headwater chub, much of the stream habitat has been destroyed or degraded, and loss of this habitat continues today (Minckley 1973; Propst 1999; Voeltz 2002). At certain locations, activities such as groundwater pumping, surface water diversions, impoundments, dams, channelization (straightening of the natural watercourse, typically for flood control purposes), improperly managed livestock grazing, wildfire, agriculture, mining, roads, logging, residential development, and recreation all contribute to riparian and cienega (wetland) habitat loss and degradation in Arizona and New Mexico (Minckley and Deacon 1991in DOI 2006; Propst 1999; Voeltz 2002).

### Comparison of Alternatives

Motorized routes can have both direct and indirect effects on headwater chub and its' habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.22 displays the miles of motorized routes within 300 feet of occupied headwater chub habitat.

**Table 3.22---Miles of NFS motorized routes within 300' of occupied headwater chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 3.30 | 2.20 | 1.60 | 1.60 | 2.10 | 2.10 |
| **Miles of Administrative Road** | 0 | 1.10 | 1.60 | 1.60 | 1.20 | 1.20 |
| **Motorized Trail < 50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 3.30 | 3.30 | 3.20 | 3.20 | 3.30 | 3.30 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -2% | -2% | 0% | 0% |

Alternatives B, C, F, and G include the same miles of motorized routes within 300 feet of headwater chub habitat. However, Alternatives C, F, and G reduce the use on about one mile of motorized route by designating the route as open for administrative use and/or with written permission, thus reducing the relative risk to headwater chub. Alternatives D and E include slightly less miles of road within 300 feet of headwater chub habitat and provide for further reduced use on slightly more miles of routes. Alternatives D and E have the lowest relative risk to the species. Alternative B has the highest relative risk to the species. Alternatives C, F, and G provide some level of reduced relative risk when compared to Alternative B.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.23 displays the number of motorized route crossings within occupied headwater chub habitat.

**Table 3.23---Number of stream crossings in occupied headwater chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 5 | 3 | 1 | 1 | 3 | 3 |
| **Low Water Administrative Road** | 0 | 2 | 4 | 4 | 2 | 2 |
| **Low Water Motorized Trail <50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Bridge** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Culvert** | 1 | 1 | 1 | 1 | 1 | 1 |
| **Total Number of Crossings** | 7 | 7 | 7 | 7 | 7 | 7 |
| **Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative** | | 0% | 0% | 0% | 0% | 0% |

All alternatives include the same number of stream crossings in headwater chub habitat. Alternatives D and E are the same and present the lowest relative risk due to most of the stream crossings being open only for administrative use and/or by written permit and subsequent reduced use. Alternative B presents the highest relative risk due to all low water crossings being open to all users. Alternatives C, F, and G reduce the relative risk to headwater chub less than Alternatives E and F due to more of the routes being open to all users. All alternatives may impact this species, but will not result in loss of species viability or create significant trends toward Federal listing.

**Roundtail Chub**

The roundtail chub is a member of the minnow family Cyprinidae. The roundtail chub is characterized by a robust body and tail trunk. It is an olive gray color with silvery sides and a white belly. The roundtail chub matures at about 3 years of age with an unknown life expectancy. Breeding males develop red or orange coloration on the lower half of the cheek and the bases of paired fins. Individuals may reach 49.0 cm (19.3 in) but usually average 25-30 cm (9.8 - 11.8 in).

Roundtail chubs occur in cool to warm water, mid-elevation rivers and streams throughout the Colorado River basin, often occupying open areas of the deepest pools and eddies of middle-sized to larger streams. They occasionally concentrate in relatively swift, turbulent waters below rapids, moving into less turbulent chutes in small groups. Roundtail chubs are often associated with cover in the form of boulders, overhanging cliffs, undercut banks, or vegetation. It is less prone to using cover than Gila or headwater chubs, typically frequenting open areas in the deepest pools and eddies of middle sized to larger streams (NMDGF 2006).

Adults feed in swift water and move back to pools or other forms of cover when disturbed (Minckley 1973). Juveniles occupy backwater habitats and tend to reside primarily in shallow, swifter habitats, as they grow older (Minckley 1973; Propst 1999).

Roundtail chub follow a seasonal spawning cycle, with spawning beginning in late spring and extending to early summer (Bestgen 1985 in Bestgen and Propst 1989; Propst 1999). In the upper Colorado River Basin, roundtail chub were observed spawning at temperatures within a range of 14°C to 24°C (Kaeding et al. 1990). Other researchers in the upper Verde River and the Colorado River have observed spawning behavior in roundtail chub when water temperatures reached approximately 18°C to 22°C (Brouder 2001). Spawning has also been associated with a descending hydrograph, when lower flows and warmer water temperatures become more prevalent (Bestgen 1985 in Bestgen and Propst 1989; Kaeding et al. 1990). Females broadcast about 2,000 tiny sticky eggs over gravel/cobble bottom. Transparent larvae [25 mm (1/3" long)] hatch in 5 days and grow to about 76 mm (3 inches) in one year (USFWS 2003). The roundtail chub matures at about 3 years of age with an unknown life expectancy. Breeding males develop red or orange coloration on the lower half of the cheek and the bases of paired fins. Breeding tubercles are present on both male and female roundtail chubs, with greater coverage on males, sometimes densely covering the entire body and fins (Muth et al. 1985).

Roundtail chub historically occurred in the Colorado River and its tributaries from Wyoming south to the Little Colorado River confluence in Arizona.

Although roundtail chubs were never collected from the Colorado River or San Pedro River basin in Mexico, they may have occurred in these areas based on records near the international border in the lower Colorado River and upper San Pedro River and the occurrence of suitable habitat in these streams in Mexico (Voeltz 2002). Throughout its range, it was historically comparatively common. Today, roundtail chub occupy only about 45% of their historical range in the Colorado River Basin (Bezzerides and Bestgen 2002 in DOI 2009).

In New Mexico and Arizona the Roundtail chub were historically found in the mainstems and many perennial tributaries of the Colorado, Little Colorado, Bill Williams, Gila, Verde, Salt, San Francisco, San Pedro, and Zuni rivers.

Currently the roundtail chub is distributed throughout the Colorado River basin. In New Mexico the species is extirpated from the San Francisco River Drainage and very rare in the Gila River Drainage. While longtime residents of the area have said that roundtail chub were moderately common and widespread in the San Francisco River below Frisco Hot Springs (Bestgen and Propst 1989), the species has not been documented in the San Francisco River since 1948 (NMDGF 2006). At NMDGF permanent monitoring sites on the mainstem of the Gila River, where annual sampling has occurred since 1987, near Riverside, Middle Box, and Lower Box sites, roundtail chub was found at the Riverside site in 1991 (Paroz et al. 2006). The U.S. Forest Service (USFS) has collected roundtail chub from the mainstem of the Gila River sporadically since 1994 (NMDGF collection permit #3138 reports; J. Monzingo, USFS, 2005, pers. obs.).

The roundtail chub is considered extirpated from much of its original mainstem habitat (Colorado, Little Colorado, Bill Williams, San Francisco, lower Gila, and the San Pedro rivers) (Voeltz 2002). Headwater chub is still found in many of its historical localities; however, threats remain for all populations (Voeltz 2002).

Severe fragmentation and alteration of aquatic habitats in the southwestern United States has likely constricted many wide-ranging aquatic species into isolated pockets. Principal causes of habitat fragmentation in the southwest are dam and reservoir construction, water diversion, groundwater pumping, and increased sedimentation resulting from a variety of land management practices (Miller 1961in DOI 2009 ). Roundtail chub populations have declined due to a combination of habitat loss and degradation related to dams, diversions, groundwater pumping, mining, recreation, livestock grazing, and competition and predation from non-native fishes. In the Colorado River basin, roundtail chub occupy only 18% of their historical range (USFWS 2003).

**Comparison of Alternatives**

Motorized routes can have both direct and indirect effects on roundtail chub and its' habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.24 displays the miles of motorized routes within 300 feet of occupied roundtail chub habitat.

**Table 3.24---Miles of NFS motorized routes within 300' of occupied roundtail chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of Motorized Road** | 2 | 1 | 0.30 | 0.30 | 0.30 | 0.30 |
| **Miles of Administrative Road** | 0 | 1 | 1 | 1 | 1 | 1 |
| **Motorized Trail < 50"** | 0 | 2 | 0 | 0 | 0 | 0 |
| **Total Miles of Motorized Routes** | 2 | 2 | 1.30 | 1.30 | 1.30 | 1.30 |
| **Change in Number of Miles of Motorized Routes Expressed as a Percent (+or-) of the No Action Alternative** | | 0% | -35% | -35% | -35% | -35% |

Alternatives B includes the most miles of motorized routes that are open to all users and presents the highest relative risk to roundtail chub. Alternative C includes the same number of motorized route miles but presents a slightly lower relative risk than Alternative B due to reduced use on some of those miles. Alternatives D, E, F, and G are the same and present the lowest level of relative risk due to a reduction in miles of motorized routes within 300 feet of roundtail chub habitat.

Motorized routes create direct and indirect impact to streams, habitats, and aquatic species at route crossing points. Motorized route crossing can indirectly decrease fish egg hatching success and subsequent fish populations due to sedimentation, can directly dislocate fish spawning activity within ford crossings, depending on fish species and spawning suitability of stream substrate and flows, and cause direct disturbances including stream bank damage, leading to indirect effects of increased bank erosion and stream sedimentation. Table 3.25 displays the number of motorized route crossings within occupied roundtail chub habitat.

**Table 3.25---Number of stream crossings in roundtail chub habitat.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Low Water Motorized Road** | 5 | 0 | 0 | 0 | 0 | 0 |
| **Low Water Administrative Road** | 0 | 5 | 5 | 5 | 5 | 5 |
| **Low Water Motorized Trail <50"** | 0 | 0 | 0 | 0 | 0 | 0 |
| **Total Number of Crossings** | 5 | 5 | 5 | 5 | 5 | 5 |

| Change in Number of Stream Crossing Expressed as a Percent (+ or – ) of the No Action Alternative | 0% | 0% | 0% | 0% | 0% |
|---|---|---|---|---|---|

All of the alternatives include the same number of stream crossings. All of the action alternatives reduce the relative risk to roundtail chub occupied habitat due to reduced use of roads that are only open for administrative and/or by written permit use. All alternatives may impact this species, but will not result in loss of species viability or create significant trends toward Federal listing.

**Longfin Dace**

The longfin dace is a small (less than 4 inches long) silvery minnow with a dark back and white on the belly. A dark band will sometimes be located along the sides just above the midsection and iridescent gold flecks may develop on the upper sides of both sexes. Longfin dace are omnivorous, feeding on various aquatic invertebrates and plants depending on the availability. Longfin dace tend to occupy relatively small streams. The range of habitat is widespread, from intermittent low-desert streams to clear and cool brooks at higher elevations.

Longfin dace tend to occupy relatively small streams. The range of habitat is widespread, from intermittent low-desert streams to clear and cool brooks at higher elevations.

Longfin dace may spawn throughout the year, but primarily in the spring. In the Colorado River Basin, longfin dace create saucer-shaped depressions where the eggs are deposited. Nests are usually excavated in shallow water 2-4 inches (5-20 cm) deep with a slight current and over sandy bottoms; eggs are buried by the spawning act. Nests arrange from 5.9-9.8 inches (15-25cm) in diameter. Hatching occurs in within 4 days. Fry stay in nest until the yolk sac is mostly absorbed before dispersing to shorelines areas. Breeding males have some yellow on the lower parts of their paired fins for a brief time (Rinne and Minkley, 1991).

Historical range of longfin dace was from upland- to low-desert streams throughout the Gila River and other drainages in Arizona, New Mexico, and Sonora. Additionally, it was successfully transplanted to waters outside its historical range, including the Rio Grande, Zuni, and Mimbres rivers in New Mexico, and Virgin River in Nevada. Longfin dace currently remains widespread throughout its range. It is probably the most successful, highly adaptable, cyprinid fish native to the southwest. Longfin dace can survive for short periods during extreme drought in low water conditions by taking refuge under filamentous algal mats and moist debris. These fish are highly opportunistic, moving rapidly through flowing water during periods of high runoff and travelling amazing distances in a relatively short amount of time (Minkley, 1973). Although longfin dace is resilient, some populations in the Gila River basin have been eliminated. Of the 257 locations where it was recorded during 1840 through 2003, 214 (83%) retain longfin dace (Desert Fishes Team, 2004). According to NatureServe (2009), population trends are unclear, apparently naturally expanding in some areas while stable or declining in other locations; threats are widespread and ongoing. Individual populations may be moved due to changes in water flow. This species can suffer massive mortalities but has the ability to recover numbers rapidly.

Reasons for disappearance from localities are multiple, but revolve around dewatering or other alteration of habitats, and introduction of nonnative species (Desert Fishes Team, 2004). Large areas of habitat have been destroyed by dewatering, stream diversion, groundwater pumping, dam construction, channel and watershed erosion, and other factors.

**Desert Sucker**

The desert sucker grows to approximately 13 inches (33 cm) in length. Its color varies from green to silver or tan above and silver to yellow below. During the spawning season breeding males develop a striped pattern consisting of one or two light lateral stripes on a darker background. The desert sucker has a downward-pointed mouth with an enlarged cartilaginous ridge behind the lower lip.

The desert sucker is omnivorous; it feeds on diatoms and algae that grow on cobbles and boulders. It uses the cartilage ridge below its lower lip to scrape food items from stream channel bottom. Any animal material present within the algae would also be eaten. Young sucker fry feed primarily on small aquatic insects such as midge and black fly larvae. Juveniles are mature by their second year of life at a length of about 10.2-12.7 cm (4-5 in) ( Arizona Game and Fish 2002).

The desert sucker is found in rapids and flowing pools of streams, primarily over bottoms of gravel-rubble with sandy silt in the interstice (Sublette et al, 1990). The desert sucker is highly adaptive to a wide range of temperatures (Sublette et al, 1990). Adult suckers live in pools, moving at night to feed on gravel-cobble riffles. Young inhabit riffles throughout the day, feeding on aquatic insects. As an adult, the species is primarily herbivorous, scraping aufwuchs from stones as well as ingesting plant detritus (Clarkson and Minckley 1988). Large adults occupy pools during the day, move to riffles at night and during periods of high turbidity. Young tend to congregate along banks in quiet water, move to swifter water as they increase in size (Minckley 1973; Sublette et al. 1990; Sigler and Sigler 1996).

Desert suckers reach maturity in their second year. Spawning occurs from January through May. Spawning occurs in gravel bars involving one female and two or more males. The female creates a depression in the gravel then deposits eggs which are fertilized by the males. The eggs, buried in the loose gravel, hatch in a few days. In New Mexico and Arizona, the desert sucker is highly co-existent with the Sonoran sucker (*Catostomus insignis*). It has been reported that the two species hybridize in some Arizona streams.

Desert suckers still occur over a relatively broad area and are currently found in river and stream systems throughout their historical range. Desert suckers are found in the Bill Williams River, Gila River, and Virgin River basins in Arizona, New Mexico, Utah, and northern Sonora, Mexico. In Nevada, it is found in the Virgin River, White River, and Meadow Valley Wash.

In New Mexico the desert sucker is native in the Gila basin and the San Francisco drainage except in extreme headwater situations (Sublette et al, 1990). The species population is stable within New Mexico (Sublette, et al, 1990).

The species is stable throughout most of its range. Alteration of historical flow regimes and construction of reservoirs have diminished available running-water habitat (Arizona Game and Fish 2002). Habitat is also lost when poor land management increases sedimentation which covers diatoms and algae growing on channel substrate (U.S. Fish and Wildlife Service 2009). In addition, non-native fish stocking has increased competition with and predation on desert suckers (U.S. Fish and Wildlife Service 2009).

**Sonora sucker**

A medium-sized catostomid fish, although adults can attain a size of 80.0 cm (31.5 in). The Sonora sucker is an omnivore, feeding in early morning and late evening on the aufwuchs assemblage of shallow pools (Sublette et al 1990). A significant component of the diet is macroinvertebrates, particularly Ephemeroptera (Clarkson and Minckley 1988), with some coarse sand occasionally ingested.

The Sonora sucker is found in a variety of habitats from warm water rivers to trout streams. It has an affinity for gravelly or rocky pools, or at least for relatively deep, quiet waters (Minckley 1973). Adults tend to remain near cover in daylight, but move to runs and deeper riffles at night. Young live and utilize runs and quit eddies. This sucker exhibits little seasonal movement despite major floods (Bestgen et al. 1987, Sublette et al. 1990).

Spawning begins in late winter and continues through midsummer (Sublette et al 1990). The female is usually attended by two males. Eggs are deposited in riffles, fall into the interstices between gravels, and incubate" (Reighard 1920 in Sublette et al. 1990). They tend to move to smaller streams or onto riffles in larger streams, but a few populations are known to spawn in lakes (Minckley 1973).

The Sonora sucker has a small range in the Gila and Bill Williams systems (Colorado River drainage) New Mexico and Arizona, also in northern Sonora, Mexico. Sublette, et al. (1990) describe the Sonora Sucker as "native to the

Gila and San Francisco drainages (except in extreme headwaters situations)" in New Mexico. The status of the species in the San Francisco and Gila River drainages is considered stable (Sublette et al 1990). The species has declined in some areas but is relatively common and stable in most of its range (Natureserve 2009; U.S. Fish and Wildlife Service 2009).

Alteration of historic flow regimes and construction of reservoirs have diminished available habitat for Sonoran Sucker. General watershed erosion causing excessive sand deposition in streams has eliminated much pool habitat required by the species (AZGF 2002). Competition and predation from non-native fishes also threatens the species (Natureserve 2009; U.S. Fish and Wildlife Service 2009).

**Rio Grande Sucker**

The Rio Grande sucker is a small-size member of the Family Catostomidae described by Baird and Girard in 1854 from specimens obtained from the Mimbres River, New Mexico. Adults are usually less than 170 mm (6.7 inches) in length. Some genetic variation has been reported from different drainages in Mexico (Ferris et al. 1982), but there is little evidence of geographic variation in the state of New Mexico (Crabtree and Buth 1987). The Rio Grande sucker is primarily algivorous (Zuckerman and Langlois 1990, Swift-Miller et al. 1999a). It co-evolved with the Rio Grande cutthroat trout (*Oncorhynchus clarki virginalis*) and the Rio Grande chub (*Gila pandora*), which filled the trophic levels of piscivore and insectivore, respectively (Zuckerman and Langlois 1990). Feeding habits of the Rio Grande sucker imply that it would prefer streams with low turbidity and minimal sediment deposition (Swift-Miller et al. 1999a). The Rio Grande sucker probably evolved with adequate food resources and limited interspecific competition (Rees and Miller 2005).

While some habitat associations have been reported, there is currently a need to study specific seasonal and life stage habitat requirements of this species. The Rio Grande sucker is an obligate riverine species (Calamusso et al. 2002). Specific life history events, diel movement, or seasonal changes probably influence habitat associations, but this information is generally lacking. In a survey of several New Mexico streams, Calamusso and Rinne (1996) found that this species preferred pool and glide habitat, but suggested that riffles may be ecologically important at certain times. Swift-Miller et al. (1999b) captured Rio Grande sucker in all major habitat types (i.e., pools, riffles, glides). Surveys in New Mexico determined that this species avoided stream reaches with a gradient greater than 3.2 percent (Calamusso et al. 2002). In fact, the data indicate an inverse relationship between abundance and gradient (down to at least 0.8 percent). Calamusso and Rinne (1996) found that adult Rio Grande suckers within the Carson and Santa Fe national forests of New Mexico preferred low gradient habitats with cobble and small boulder substrate (64 to 500 mm [2.5 to 19.7 inches]). Velocity was usually less than 20 cm per second (0.7 ft. per second) but could be as high as 113 cm per second [3.7 ft. per second]). Preferred depth ranged from 10 to 40 cm (3.9 to 15.7 inches). The deposition of fine sediments has been found to negatively impact the abundance and condition of Rio Grande suckers (Swift-Miller et al. 1999a). The amount of sand/silt substrate was inversely related to fish density in each habitat unit in Hot Creek (Swift-Miller et al. 1999b). Similarly, Rio Grande sucker condition was negatively related to the proportion of fine sediment in streams that were surveyed in Colorado and New Mexico (Swift-Miller et al. 1999a). The Rio Grande sucker may have an affinity for larger substrate because the stability associated with coarse substrate provides a greater opportunity for algal growth and macroinvertebrate production (Calamusso and Rinne 1996), which comprise the dominant proportions of the Rio Grande sucker's diet (Zuckerman and Langlois 1990).

Runoff patterns, thermal regime, and season can all influence the time of spawning for western catostomids (Rinne 1995). Rinne (1995) reported that spawning occurs in June and July in the Rio de las Vacas in northern New Mexico. Rio Grande sucker on the Gila National Forest have been observed in spawning condition from late March through late May (J. Monzingo pers. Obs.). Koster (1957) indicated that spawning occurs over areas of clean gravel substrate.

The Rio Grande sucker is endemic to the Rio Grande Basin. Historically, it was common throughout the Rio Grande and associated tributaries. The current distribution of this species includes two states (New Mexico and Colorado) and several locations in Mexico (Sublette et al. 1990). In New Mexico the species is found in the Rio Grande, the tributary streams of the Rio Grande, and the Mimbres River. It has been introduced, probably via bait bucket, into the Rio Hondo and into the San Francisco drainage (Sublette et al. 1990). It also occurs in several tributary streams of the Gila River; however it is uncertain whether or not these populations originated naturally via a stream capture from the Mimbres River or were introduced (D.L. Propst pers. Comm.).

The species appears to be declining across its northern range in New Mexico (Calamusso and Rinne 1996, Calamusso et al. 2002). Rio Grande sucker populations have likely been reduced due to depleted flows that result in increased temperatures, dewatering, etc.; habitat alteration from siltation, channelization, etc.; habitat destruction, including pollution, transbasin diversions, etc.; and interactions with non-native fish (Zuckerman and Langlois 1990). In many systems, interactions with non-native fish species have been cited as the primary cause for decline in range and density of Rio Grande suckers (Calamusso et al. 2002). In the Mimbres River the population is stable (Sublette et al. 1990) and the Gila drainage populations are established.

Human-induced changes in the ecology of the Rio Grande drainage may be responsible for the decline of this species throughout most of its range (Rees and Miller 2005). Water development, overgrazing, and other land use practices (i.e., channelization for agriculture, timber harvest practices, road management, mining) have resulted in increased sediment loads in many western streams (Rees and Miller 2005). Judy et al. (1984) described sedimentation as the most important factor that is limiting fish habitat in the United States. The presence of suspended sediment has been found to impact periphyton communities by increasing turbidity (resulting in a decrease in light penetration), and it can cause the removal of periphyton by a frictional scouring process (Newcombe and MacDonald 1991). The deposition of fine sediments on periphyton communities is suspected to have a smothering effect (Waters 1995) and to decrease the nutritional value of periphyton by increasing the inorganic content (Graham 1990).

**Comparison of Alternatives**

Longfin dace, Sonora, and desert sucker are widespread species in the Gila-San Francisco River basin on the Gila National Forest. Longfin dace also occur, as non-native invasives, in the Rio Grande and Mimbres Drainage basins on the Forest. Rio Grande sucker is wide spread in the Rio Grande and Mimbres Drainage basins on the Forest. Rio Grande sucker also occurs, as a non-native, in the Upper San Francisco River drainage and several streams in the Gila River drainage. Since the Longfin dace and Rio Grande sucker occur in multiple drainage basins on the Gila National Forest and the desert and Sonora sucker are widespread in the Gila-San Francisco Drainage the total miles of road within 300 feet of perennial and intermittent streams (see table 3.1) and the total number of stream crossings on perennial and intermittent streams (see table 3.2) are utilized to display the levels of relative risk for each alternative.

Alternative E presents the lowest level of relative risk to these species due to including the fewest stream crossing, the fewest miles of motorized routes and the most miles of open routes that open only by written permission or for administrative use. Alternative D is similar to Alternative E but presents a slightly increased level of risk to these species due to more stream crossings and fewer miles of motorized routes that will be non-motorized. Alternative B presents the highest level of relative risk to these species due to having the highest number of stream crossings and the highest level of use on NFS motorized routes (i.e. all motorized routes are open to all users). Alternative C is similar to Alternative B with a slightly lower level of risk due to reduced use on routes that will be non-motorized and open only by written permission and/or for administrative use. Alternatives F and G are similar and present a level of relative risk that is less than Alternatives B and C but higher than Alternatives D and E. Alternative G presents a slightly lower level of relative risk than Alternative F due to fewer stream crossings and fewer miles of motorized routes. All of the action alternatives reduce the miles of motorized routes, the number of stream crossings, and the level of motorized use when compared to the existing condition. All alternatives may impact these species, but will not result in loss of species viability or create significant trends toward Federal listing.

**Rio Grande Chub**

The Rio Grande chub reaches up to 250 mm (9.8 inches) total length (TL) in lacustrine habitats but averages 130 to 150 mm (5.1 to 5.9 inches) TL in most streams (Zuckerman and Langlois 1990). Very little information exists on the feeding habits of the Rio Grande chub. This species is an omnivore that is known to feed on aquatic and terrestrial insects, crustaceans, other small invertebrates, small fish, plankton, and some vegetation (Koster 1957). Some general information on habitat associations for the Rio Grande chub is available, but specific seasonal and life history information is relatively limited.

The Rio Grande chub is usually found in pools with overhanging banks and brush (Rinne 1995). Platania (1991) found the Rio Grande chub to be part of a guild preferring cool, fast-flowing reaches with gravel or cobble substrate. Bestgen et al. (2003) found that substrate particle size, stream width, and presence of brown trout were important variables that explained the presence of Rio Grande chub in the Rio Grande Basin, Colorado. They found chubs at sites where cobble, gravel, sand and silt were the most common substrate types. Chubs were most often found at sites where sand was the dominant substrate and least often found at sites with cobble substrate (Bestgen et al. 2003 in Rees et al 2005). Rio Grande chub often utilize undercut banks in association with aquatic macrophytes, (i.e., *Potamogeton* sp.) (Jordan 1891). Larger specimens can be found in pools and runs, and below instream structures (Zuckerman and Langlois 1990). Young chubs can be found in beds of aquatic macrophytes (i.e. *Nasturtium officinale*), and utilizing the cover provided by overhanging banks (Zuckerman and Langlois 1990). However, the relative importance of these habitats to each life stage of the Rio Grande chub is unknown.

Spawning occurs in spring and early summer (Sublette et al 1990). Stream populations of Rio Grande chub spawn in riffle habitat without building nests and provide no parental care after egg laying (Koster 1957). No information is available on the behavior of this species during spawning.

The native range of the Rio Grande chub is thought to have included most streams in the Rio Grande and Pecos River basins (Sublette et al. 1990) and the San Luis Closed Basin (Zuckerman and Bergersen 1986, Zuckerman and Langlois 1990). This species is likely extirpated from the mainstem Rio Grande and now is found only in tributary streams (Bestgen et al. 2003 in Rees et al. 2005). Although present in all sample sites collected between 1981 and 1985, the Rio Grande chub was only present in only 25 percent of the locations sampled in the Rio Grande Basin from 2001-2002 (Bestgen et al. 2003 in Rees et al. 2005). The Rio Grande chub is widespread in New Mexico in suitable habitat throughout the Rio Grande drainage (Calamusso and Rinne 1996). Populations were only present in reaches with gradients less than 2 percent and at elevations ranging 1,717 to 2,810 m (5,633.2 to 9,219.6 ft.). The Rio Grande chub has also been introduced into the headwaters of the Canadian River, New Mexico. Platania (1991) found Rio Grande chub to be most common in the reaches of the Rio Grande upstream of the confluence with the Rio Chama than downstream of the Rio Chama. There are several populations of Rio Grande chub in Colorado and many populations throughout New Mexico (Zuckerman and Langlois 1990, Calamusso and Rinne 1996, Bestgen et al. 2003 in Rees et al. 2005). While populations in New Mexico are still considered stable, this species has substantially declined from historical levels in both Colorado and New Mexico.

Probable factors contributing to the decline of Rio Grande chub include competition with and predation by introduced brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*), habitat fragmentation due to impoundments, destruction of habitat due to cattle grazing and other land use practices (e.g., road building, timber harvesting, mining) (Bestgen et al. 2003; Rees et al 2005).

**Comparison of Alternatives**

The Rio Grande chub currently or recently occupied several streams on the Gila National Forest. Current distribution is limited to Animas Creek downstream of the Forest and possibly South Fork Palomas and North Fork Seco Creeks, on private property. All of the alternatives include the same number of miles of motorized route and stream crossings (Table 2.26). Alternative B presents the highest level of relative risk to the species because all of the routes are open to all users and use will be higher. All of the action alternatives reduce the relative risk to Rio Grande Chub due to decreased use on routes that are designated as administrative and/or use by written permit only and the subsequent reduction in use of stream crossings associated with these roads. All alternatives may impact the species, but will not result in loss of species viability or create significant trends toward Federal listing.

Table 3.26---Miles of NFS motorized routes and number of stream crossings in Rio Grande Chub habitat.

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| Miles of NFS motorized routes within 300' of perennial and intermittent streams | 11 | 6 | 6 | 6 | 6 | 6 |
| Miles of Administrative routes | 0 | 5 | 5 | 5 | 5 | 5 |
| Total miles of motorized routes | 11 | 11 | 11 | 11 | 11 | 11 |
| Number of NFS stream crossings | 38 | 9 | 9 | 9 | 9 | 9 |
| Number of stream crossings on Administrative routes | 0 | 29 | 29 | 29 | 29 | 29 |
| Total number of stream crossings | 38 | 38 | 38 | 38 | 38 | 38 |

**Gila Springsnail**

Other than general habitat associations, little is known of the specific natural history and biology of Gila springsnails. The species is entirely aquatic and, as with most other freshwater gastropods, Gila springsnails likely consume algae, bacteria, and decaying organic material (U. S. Fish and Wildlife Service 2009c).

About 13 populations of Gila springsnails are reported from a variety of isolated springs in the upper Gila River basin drainage in Catron and Grant Counties, New Mexico (Hershler 1994, BISON M, U. S. Fish and Wildlife Service 2009c). In the East Fork Gila River drainage system, the species occurs at several springs along the mainstem about 5 to 8 km (3 to 5 mi) upstream of its mouth, and at Fall Spring (Stefferud 1986). The species also occurs at springs along Beaver Creek and Taylor Creek, which form the headwaters of the East Fork Gila River. The mainstem Gila River population is known only from Alum Spring. Within these springs, the species is associated with habitats ranging from cool spring (20º C (68º F)), pool-run complexes with watercress rivulets, to thermal (32-33º C (89-91º F)) springheads (U. S. Fish and Wildlife Service 2009c).

At thermal springs in the East Fork and at Alum Spring on the Gila River, Gila springsnail is sympatric with New Mexico hot springsnail (*Pyrgulopsis thermalis*). Within these springs, however, the Gila and New Mexico hot springsnails are typically segregated to cooler and warmer water microhabitats, respectively (Stefferud 1986).

Most Gila springsnail populations occur on lands administered by the Gila NF, including two sites within the Gila Wilderness (U. S. Fish and Wildlife Service 2009). Even the few sites on private lands, however, are in watersheds that include FS lands. The geographically restricted distribution of the Gila springsnail increases the vulnerability of the species to human-caused or natural events that could eliminate the species or extirpate populations that could not be re-colonized (U. S. Fish and Wildlife Service 2009c). Natural stochastic events (drought, forest fire, sedimentation, flooding), wetland habitat degradation and contamination from recreational bathing at thermal springs, and poor watershed management practices represent primary potential threats to the populations on federal and private lands (U. S. Fish and Wildlife Service 2009c).

**New Mexico Hot Springsnail**

Other than general habitat associations, little is apparently known of the specific natural history of New Mexico springsnail. The species is entirely aquatic and, as with most other freshwater gastropods, Gila springsnails likely consume algae, bacteria, and decaying organic material (U. S. Fish and Wildlife Service 2007a).

The species is known from a series of thermal springs in New Mexico along the East Fork of the Gila River and at an isolated thermal spring (Alum Spring) on the mainstem Gila River (Stefferud 1986; BISON M). The species inhabits shallow sheets or trickles of spring outflow, often on algal films occurring on vertical rock faces.

Gila Springsnail (Pyrgulopsis gilae) occurs at all New Mexico springsnail sites, although the two species are typically segregated to cool and warm water microhabitats, respectively (Stefferud 1986). Both species do occur in thermal waters, although Gila springsnails do not inhabit extreme New Mexico springsnail habitat on vertical rock in warm water (U.S. Fish and Wildlife Service 2007a).

The Gila River mainstem population (Alum Spring) occurs in the Gila Wilderness, most of the East Fork Gila River populations occur on Gila NF lands within a corridor extending a few miles upstream of the Gila River mainstem.

There is no documentation that any New Mexico springsnail populations have been extirpated (U. S. Fish and Wildlife Service 2007a). However, the very limited geographic range and isolation of occupied sites from each other likely increases the vulnerability of the species. A variety of potential threats to New Mexico springsnail populations and their habitats have been identified by U.S. Fish and Wildlife Service (2007a) including "natural stochastic events (forest fire, flooding, sedimentation), poor watershed management, and water pollution and contaminants from recreational bathing and fire suppressant chemicals…" Intense recreational or livestock use on springs where the species is found may result in increased sedimentation, reductions in water quality, reduced spring flow, and temperature changes.

**Comparison of Alternatives (Gila and New Mexico Hot Springsnails)**

Motorized routes can have both direct and indirect effects on springsnails and their habitat. Motorized routes cause the physical loss of riparian habitat and functions, create drainage pathways that follow route treads and alter surface water pathways, and convert dispersed surface run-off and sediment filtering throughout the riparian area, to direct (point source) deliveries of accumulated runoff and sediment. Table 3.27 displays the miles of motorized routes within 300 feet of occupied Gila and New Mexico hot springsnail habitat.

**Table 3.27---Miles of NFS motorized routes within 300' of New Mexico Hot Springsnail and Gila Springsnail populations.**

| | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Miles of NFS Motorized Routes Within 300' of NM Hot Springsnail Populations** | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Miles of NFS Motorized Routes Within 300’ of Gila Springsnail Populations** | 0.05 | 0 | 0 | 0 | 0 | 0 |

All action alternatives propose no motorized routes within 300 feet of known Gila and New Mexico hot springsnail locations. Alternative B presents some level of relative risk to the Gila springsnail due to 0.05 miles of motorized route being located within 300’ of a known occupied site. All action alternatives would have no impact on the Gila and New Mexico hot springsnails. Alternative B may impact the Gila Springsnail, but will not result in loss of species viability or create significant trends toward Federal listing and would have no impact on the Gila springsnail.

**Mountainsnails and Woodland snails**

There are seventeen Region 3 sensitive species or subspecies of mountainsnails and woodland snails that occur on the Gila National Forest. Most of the occurrence records for these snails are historic and based on general localities rather than exact locations of populations (ie. the bearded mountainsnail is known to occur in canyons between Dry Creek and Willow Creek). Many of the localities are within wilderness areas and are not susceptible to disturbance from motorized uses. Most of the species or subspecies are known from only a single locality, few have been identified in more than two localities. Major threats include small population size, catastrophic wildland fire, climate change, mining, disturbance of talus slopes, and road building.

**Comparison of Alternatives**

All of the action alternatives reduce the relative risk to these species by eliminating cross country travel, reducing or eliminate off road use associated with motorized big game retrieval (MBGR) and motorized dispersed camping, reducing the miles of routes open for motorized use, and reducing use on some routes. Alternative E presents the lowest relative risk to these species by completely eliminating cross country travel including for MBGR and motorized dispersed camping: and reduces the miles of open routes and motorized use the greatest. Alternative B presents the greatest relative risk by allowing cross country travel, MBGR, and motorized dispersed camping across the entire forest, excluding wilderness, RNAs, and ORV areas, and having the most miles of open motorized routes. Alternative F and G present similar levels of relative risk with alternative G having a slightly reduced level over Alternative F due to slightly fewer miles of motorized routes, reduced areas available for MBGR and motorized dispersed camping. Alternative D presents a level of relative risk that is higher than Alternative E but substantially less than Alternatives B,C,F and G. All alternatives may impact these species, but will not result in loss of species viability or create trends toward Federal listing.

### Southwestern Region sensitive aquatic species that occur on the Gila National Forest effects determinations

Table 3.28 below displays the effects determinations for the Southwestern Region Sensitive Species that occur on the Gila National Forest.

Table 3.28---Gila National Forest, Southwestern Region Sensitive Aquatic Species Effects Determinations.

| Species | Alt. B | Alt. C | Alt. D | Alt. E | Alt. F | Alt. G |
|---|---|---|---|---|---|---|
| **Rio Grande cutthroat trout** | | NI | NI | NI | NI | NI |
| **Headwater chub** | | MI | MI | MI | MI | MI |
| **Roundtail chub** | | MI | MI | MI | MI | MI |
| **Gila springsnail** | | NI | NI | NI | NI | NI |
| **New Mexico hot springsnail** | | NI | NI | NI | NI | NI |
| **Longfin dace** | | MI | MI | MI | MI | MI |
| **Sonora sucker** | | MI | MI | MI | MI | MI |
| **Desert sucker** | | MI | MI | MI | MI | MI |
| **Rio Grande chub** | | MI | MI | MI | MI | MI |
| **Rio Grande sucker** | | MI | MI | MI | MI | MI |
| **Black Range Mountainsnails**<br>*Oreohelix swopei*<br>*Oreohelix metcalfei acutidiscus*<br>*Oreohelix metcalfei metcalfei*<br>*Oreohelix pilsbryi*<br>*Oreohelixs metcalfei concentric*<br>**Bearded Mountainsnail**<br>*Oreohelix barbata*<br>**Subalpine Mountainsnail**<br>*Oreohelix subrudis*<br>**Whitewater Woodlandsnail**<br>*Ashmunella danielsi*<br>**Silver Creek Woodlandsnail**<br>*Ashmunella binneyi*<br>**Iron Creek Woodlandsnail**<br>*Ashmunella mendex*<br>**Dry Creek Woodlandsnails**<br>*Ashmunella tetradon inermis*<br>*Ashmunella tetradon mutator*<br>*Ashmunella tetradon tetradon*<br>*Ashmunella tetradon animorum*<br>**Black Range Woodlandsnails**<br>*Ashmunella cockerelli cockerelli*<br>*Ashmunella cockerilli argenticola*<br>*Ashmunella cockerelli perobtusa* | | MI | MI | MI | MI | MI |

NI= No Impact

MI= May Impact, but will not result in loss of species viability or create trend toward Federal listing

**Gila National Forest Management Indicator Species**

**Gila Trout** (see threatened and endangered species section)

**Rio Grande Cutthroat Trout** (see sensitive species section)

**Cumulative Affects**

**Conclusions**

• At the *forest-wide scale*, Alternative B (No Action) would be expected to have the greatest potential to adversely affect aquatic habitats and species because Alternative B includes the greatest overall length of motorized route, has the most miles of motorized route within 300 feet of perennial and intermittent streams, the highest number of stream crossings, and motorized cross country travel is permitted.

• All action alternatives propose to prohibit motorized cross country travel except where, in some alternatives, it is allowed for motorized dispersed camping and/or motorized big game retrieval. All action alternatives decrease and/or remove the level of relative risk to aquatic habitat and species from motorized cross country travel.

• At the *forest-wide scale*, Alternative C would be expected to present the greatest relative risk of adversely affecting aquatic habitats and aquatic-species of the action alternatives. Alternative C includes the greatest number of miles of motorized routes, the greatest number of miles of motorized route within 300 feet of perennial and intermittent streams, and the greatest number of stream crossings. Alternative C proposes to convert the greatest length of current NFS non-motorized trails and reopen closed and decommissioned routes to motorized use. Alternative C includes the greatest number of acres across the forest landscape where motorized dispersed camping and motorized big game retrieval activities could occur.

• At the forest-wide scale, Alternative D presents the second lowest level of relative risk to aquatic habitat and species. This alternative includes fewer miles of motorized routes, motorized routes within 300 feet of perennial and intermittent streams and stream crossings then Alternatives B, C, F, and G but greater numbers of these indicators then Alternative E. This alternative also reduces the relative risk to aquatic habitat and species greater than Alternatives B, C, G and F by proposing less area on the Forest that would be subject to motorized cross country travel associated with motorized dispersed camping and motorized big game travel. However, Alternative D does propose more area that would be subject to these activities then Alternative E.

• At the *forest-wide scale*, Alternative E would be expected to present the lowest relative risk of adversely affecting aquatic habitats and aquatic species of all action alternatives. Alternative E proposes the fewest miles of motorized routes, the fewest miles of motorized routes within 300 feet of perennial and intermittent streams, and the fewest stream crossings. Alternative E proposes to reopen the fewest miles of closed and/or decommissioned routes and eliminates relative risk associated with motorized dispersed camping and motorized big game retrieval. Alternative E also reduces use on the most miles of motorized route by proposed the most miles of routes that would only be available for use by written permit and/or for administrative uses.

• At the forest-wide scale, Alternatives F and G present similar levels of relative risk to aquatic habitat and species. Both alternatives present lower levels of risk then Alternatives B and C and increased levels of relative risk when compared to Alternatives D and E. Alternative G proposes fewer miles of motorized routes, motorized routes within 300 feet of perennial and intermittent streams, and stream crossing then Alternative F. Alternative G also proposes a reduction in the area that is subject to motorized dispersed camping and motorized big game retrieval. Both Alternatives F and G propose the same miles of closed and decommissioned routes to be reopened.

• At the special status aquatic species and habitat level the relative risk of each alternative generally follows the same trend as the level of risk at the forest-wide scale. Alternative B presents the greatest relative risk and Alternative E presents the lowest relative risk. Alternative F and G are similar and present lower relative risk levels then Alternatives B and C. Alternative D presents a lower level of relative risk then Alternatives B, C, F and G but a higher level then Alternative E.

## Irreversible and Irretrievable Commitment of Resources

Irreversible commitments of resources are those that cannot be regained, such as the extinction of a species or the removal of mined ore. Irretrievable commitments are those that are lost for a period of time such as the temporary loss of timber productivity in forested areas that are kept clear for use as power line rights-of-way or roads or the loss of soil productivity, wildlife habitat, and vegetation when roads are constructed. The loss will be irretrievable for the life of the road. A previous commitment of resources associated with the existing motorized travel system on the Forest exists.

The implementation of any of the alternatives, including the no action alternative, would have no new irreversible or irretrievable commitment of aquatic resources. All alternatives define the road and motorized trail system. The action alternatives consider some or all of the following: adoption of some unauthorized routes, re-opening some closed and decommissioned routes, motorizing some non-motorized trails, and non-motorizing roads and trails not needed for the transportation system. None of the alternatives consider new construction. No alternative proposes decommissioning of non-motorized routes. None of these new routes, proposed to be motorized in each alterative, are located adjacent to or have route-stream crossings in perennial, fish bearing streams.

### Cumulative Effects

Cumulative effects are the combined impacts of past, present and reasonably foreseeable events on the indicators that were identified and utilized to determine the relative risk of affects to aquatic species and habitats. Activities considered include those directly modifying aquatic habitat and those indirectly affecting sediment delivery. For activities that directly and indirectly affect water quality, riparian vegetation, and watershed condition see the hydrology report. These habitats have been altered in many cases by past road and trail construction, vegetation management, domestic livestock grazing, recreation activities, motorized cross country travel, and other factors. The following analysis was derived by reviewing the compilation of past and present programs and activities presented in the Hydrology Report for this project (2010 - see project file).

The net effect of past programs and activities was a reduction in aquatic habitat quantity and quality from pristine conditions. However, these effects are highly variable and localized. In general, present programs and activities are at best reducing impacts or not increasing impacts at worst, with the net effects combining to reduce negative effects to aquatic resources. Most important among these activities, in terms of magnitude of beneficial effects, projects to restore fish populations and aquatic habitat, modification of range management methods including exclusion of livestock from major drainages, vegetation management, and reduced road construction related to timber harvest. Although localized degraded habitats continue to be present, the overall Forest trend for aquatic habitat and species is positive.

Although some programs and activities will maintain existing effects on aquatic biota and their habitats, and others may have localized short-term negative effects, the net combined effects of reasonably foreseeable programs and activities are also beneficial with regard to aquatic species and habitat. Reasonably foreseeable actions that are expected to occur include reauthorization of grazing permits, vegetation management projects (mechanical thinning and prescribed fire), fuel wood gathering, road and trail improvement, aquatic habitat improvement projects, native fish restoration projects, and development of recreational opportunities.

Alternative B, the No Action Alternative, has the highest potential to result in adverse cumulative impacts to aquatic resources. This is primarily related to

the continuation of open cross-country travel across the Forest, including sensitive riparian areas, streams occupied by rare aquatic resources, and other stream corridors. This alternative also allows all unauthorized routes currently identified as part of the Forest travel system to continue to be utilized and risk of additional unauthorized routes to develop.

Cumulative effects related to sediment delivery decrease from Alternative B in all action alternatives with Alternative E presenting the lowest level of relative risk and Alternative C presenting the greatest. However, the decrease is sediment is likely to be small because the routes that are being non-motorized will remain on the landscape and continue to produce sediment. The relative risk of negative cumulative effects related to the direct effect of motorized routes at stream crossings also decreases in all action alternatives when compared to the no action alternative. Again, Alternative E presents the lowest level of cumulative effects risk and Alternative C the greatest. All of the action alternatives prohibit cross country travel, reduce the miles of motorized routes, reduce motorized use levels on some routes, and limit or prohibit activities such as motorized big game retrieval and motorized dispersed camping. Cumulative effects will increase, from Alternative E with the lowest level, in order from D, G, F, and C.

## VI. Relevant literature

Trombulak and Frissell (2000) reviewed the scientific literature on the ecological effects of roads and found support for the general conclusion that they are associated with negative effects on biotic diversity in both terrestrial and aquatic ecosystems. They noted that not all species and ecosystems are equally affected by roads, but overall the presence of roads is highly correlated with changes in species composition, population sizes, and hydrologic and geomorphic processes that shape aquatic and riparian systems. Current knowledge about the ecology of roads includes information on water, sediment, and streams. The effects of roads on aquatic habitat are believed to be widespread. Influences of roads on aquatic habitats and species likely includes changes to timing, frequency and magnitude of disturbances. Increased fine-sediment in substrates has been linked to decreased fry emergence, decreased juvenile densities, loss of winter carrying capacity, and increased predation of fishes. Road effects can also include reduced benthic species populations. Roads can act as barriers to migration, lead to water temperature changes, and alter stream flow. Roads increase sediment loads by acting as extensions of stream systems and increasing drainage density.

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