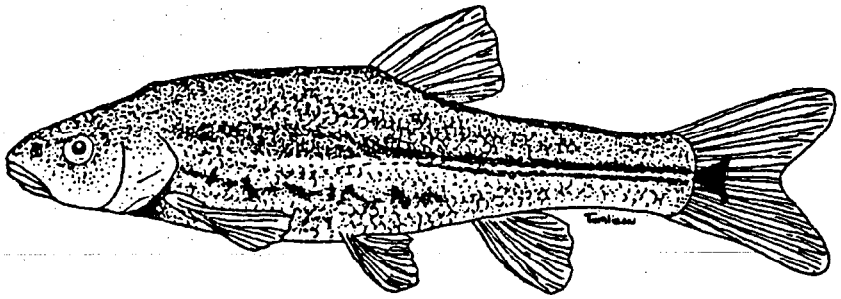
SONORACHUB RECOVERY PLAN



U.S. FISH & WILDLIFE SERVICE
DEPARTMENT OF THE INTERIOR

Phoenix, Arizona **October 1992**

SONORA CHUB, *Gila ditaenia*

RECOVERY PLAN

Prepared by

Jerome A. Stefferud

Tonto National Forest

Phoenix, Arizona

for

Region 2

U. S. Fish and Wildlife Service

Albuquerque, New México

Approved: Lynn B. Starnes

ACTING Regional Director, U.S. Fish and Wildlife Service

Date: SEP 30 1992

DISCLAIMER

Recovery plans delineate reasonable actions required to recover and protect the species. The U. S. Fish and Wildlife Service prepares the plans, sometimes with the assistance of recovery teams, contractors, State and Federal agencies, and others. Objectives are attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved, as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor official positions or approval of any persons or agencies involved in the plan formulation, other than the USFWS. They represent the official position of the USFWS only after they have been signed by the Regional Director or Director as approved. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citation should read as follows:

U. S. Fish and Wildlife Service. 1992. Recovery Plan for Sonora chub (*Gila ditaenia*). U.S. Fish and Wildlife Service, Region 2, Albuquerque, New Mexico. 50 pages.

Additional copies may be purchased from:

Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
Bethesda, Maryland 20814
301/492-6403 or l-800-582-3421

The fee for documents varies depending on the number of pages.

ACKNOWLEDGEMENTS

Preparation of the Sonora Chub Recovery Plan benefited from review and comments by the Desert Fishes Recovery Team., which has included the following individuals. Affiliations noted are for the time of association with the Recovery Team.

W. L. Minckley, Team Leader, Arizona State University, Department of Zoology
Francisco J. Abarca-Gonzalez, Team Member, Arizona Game and Fish Department
Thomas A. Burke, Team Member, USDI, Bureau of Reclamation
Dean A. Hendrickson, Team Member, Arizona Game and Fish Department
Lourdes Juárez-Romero, Team Member, Centro Ecológico de Sonora
William G. Kepner, Team Member, U. S. Fish and Wildlife Service
David L. Propst, Team Member, New Mexico Department of Game and Fish
Kniffie Hamilton, Team Member, USDI, Bureau of Land Management
Jeffery R. Simms, Team Member, USDI Bureau of Land Management
Jerome A. Stefferud, Team Member, USDA, Forest Service
Alejandro Varela-Romero, Team Member, Centro Ecológico de Sonora
James E. Brooks, Consultant, U. S. Fish and Wildlife Service
David L. Galat, Consultant, Arizona State University
Edward M. Lorentzen, Consultant, U. S. Fish and Wildlife Service
Paul C. Marsh, Consultant, Arizona State University Center for Environmental Studies
Benjamin Robertson, Consultant, U. S. Fish and Wildlife Service
Sally E. Stefferud, Service Representative, U. S. Fish and Wildlife Service

Many other persons reviewed and provided information for the preparation of this plan. The USFWS appreciates the help provided by team members (past and present), consultants, and other individuals who contributed to the preparation of this document.

EXECUTIVE SUMMARY

Status: Sonora chub is listed as threatened with critical habitat. In the United States, it occurs in the Sycamore Creek drainage, Santa Cruz County, Arizona. In Mexico, it occurs in the rios Magdalena and Altar, Sonora.

Habitat Reauirements and Limiting Factors: Sonora chub inhabits intermittent streams where it occurs in pools near cliffs, boulders, or other cover in the channel. Introduction of normative fish that prey on or compete with the species and degradation of habitat are the principal threats to the species.

Recovery Objective: Protection. Delisting is unlikely to occur due to presence Of normative species, degradation of habitat, and continued demand for water for human consumption.

Recovery Strategy: To maintain populations of Sonora chub in all extant locations. To monitor for presence of nonnative fishes and remove these fish as necessary. To protect existing habitat from degradation.

Actions Needed:
1. Protect remaining populations.
2. Monitor population and habitat dynamics.
3. Maintain captive reserves.
4. Public education in the United States and México.

Costs ($000's):

Year	Need 1	Need 2	Need 3	Need 4	Total
1	10.0	47.5	10.0	3.5	71.0
2	11.0	43.0	20.0	2.0	76.0
3	8.0	41.0	12.0	1.0	62.0
4	7.0	25.0	10.0	1.0	43.0
5	12.0	25.0	10.0	1.0	48.0
6	7.0	25.0	10.0	1.0	43.0
7	12.0	25.0	10.0	1.0	48.0
8	7.0	25.0	10.0	1.0	43.0
9	12.0	25.0	10.0	35	50.5
10	7.0	25.0	20.0	1.0	53.0
Total Cost of Protection:	93.0	306.5	122.0	16.0	537.5

TABLE OF CONTENTS

DISCLAIMER ii

ACKNOWLEDGEMENTS iii

EXECUTIVE SUMMARY iv

I. INTRODUCTION 1
- Description 6
- Distribution and Abundance 7
- Life History.. 10
- Reasons for Decline 14
- Conservation Efforts 18

II. RECOVERY 21
- Objective.. 21
- Narrative Outline 22
- Literature Cited 40

III. IMPLEMENTATION SCHEDULE 44
- Definition of Priorities 44
- Abbreviations Used 44

IV. COMMENTS RECEIVED 47

I. INTRODUCTION

Sonora chub (*Gila ditaenia* Miller), is endemic to streams of the Rio de la Concepción (=Río Ascunción) drainage of Sonora and Arizona (Fig. 1). In Sonora, it inhabits the rios Altar and Magdalena. In Arizona, it occurs in Sycamore Canyon (Creek), a tributary of the Rio Altar 25 kilometers (15.5 miles) west of Nogales, Santa Cruz County (Fig. 2). Many authors have mentioned this species and its limited geographic distribution (Miller 1949, Branson et al. 1960, Miller and Lowe 1967, Minckley and Deacon 1968, Minckley 1973 1980 1985, Minckley and Brown 1982, C.O. Minckley 1983, Bell 1984, Minckley and Brooks 1985, Minckley et al. 1986, Hendrickson and Juárez-Romero 1990, and Page and Burr 1991, and DeMarais and Minckley 1992).

Sonora chub has only recently been considered by the scientific community as biologically imperiled throughout its range in the United States. A status report by Minckley (1983) recommended Federal listing as threatened. Williams et al. (1985) considered its status to be indeterminate, and the American Fisheries Society considered it a species of special concern (Williams et al. 1989).

Sonora chub was originally listed by the state of Arizona under Group 3, which included "Species or subspecies whose continued presence in Arizona could be in jeopardy in the foreseeable future" (Arizona Game and Fish Commission 1982). In 1988, it was reclassified in Arizona as endangered, i.e., "...those species for which extinction or

Figure 1. Place names used in text in Rio de la Concepción basin, Sonora and Arizona.

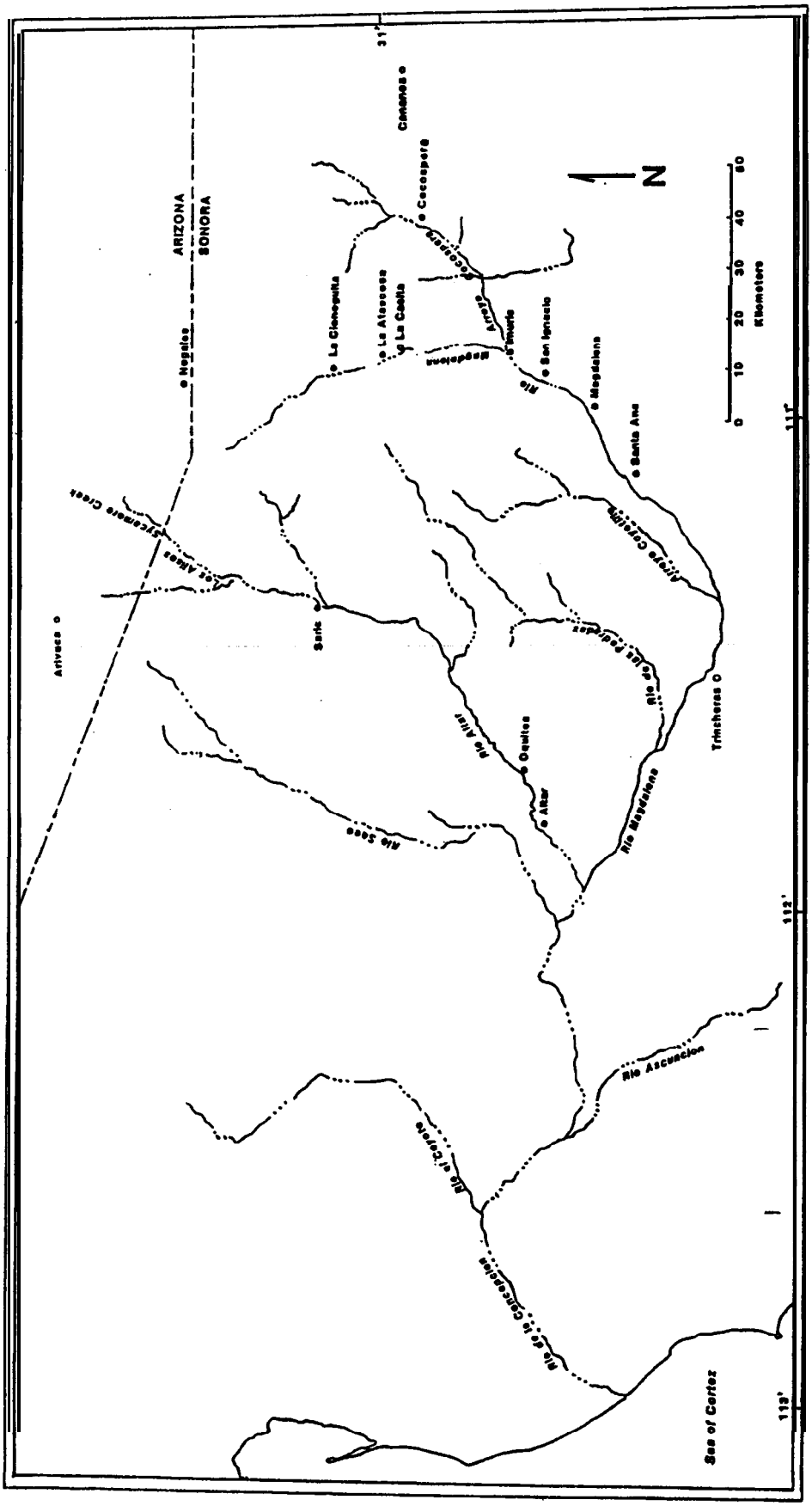
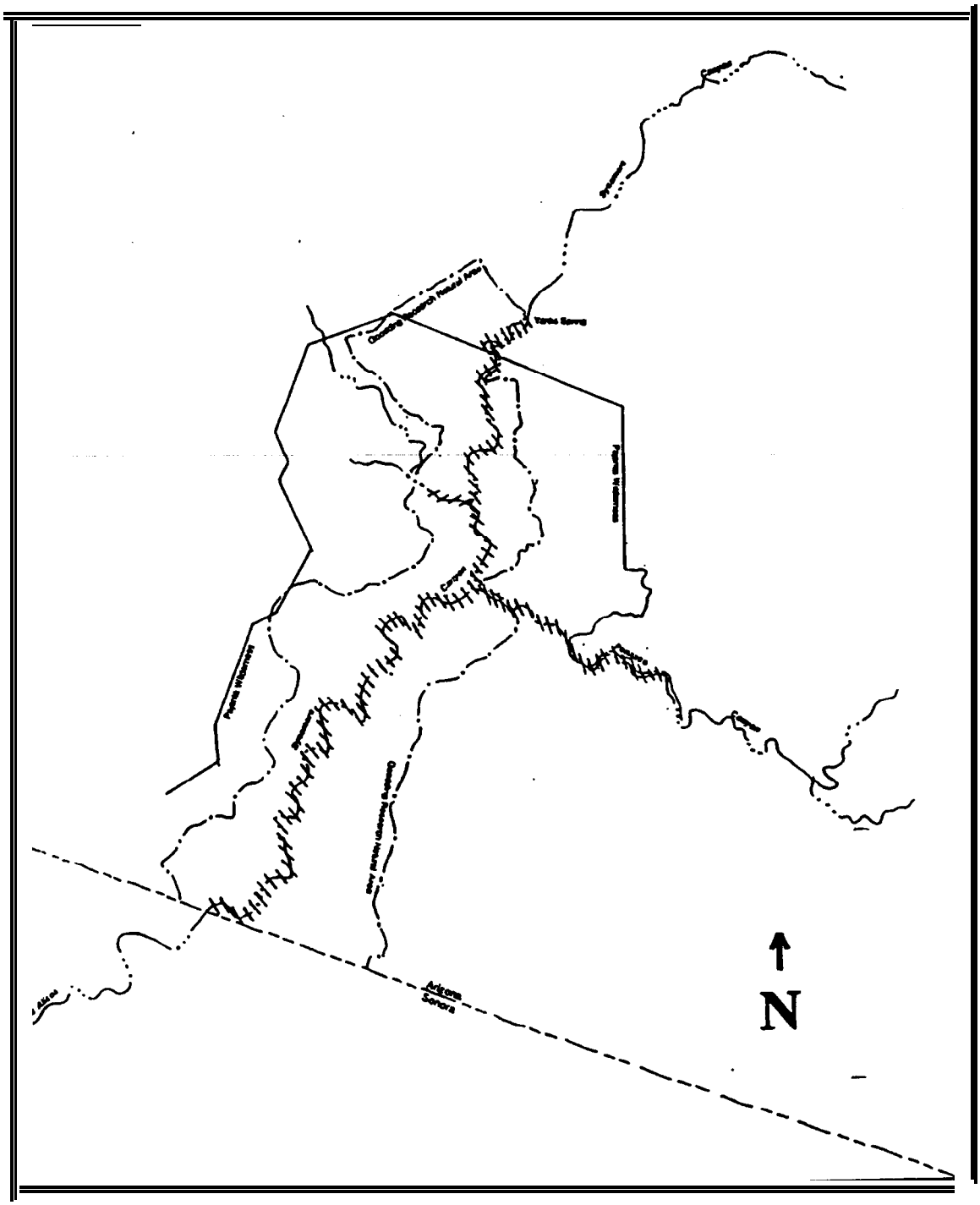


Figure 2. Place names used in text and critical habitat in Sycamore Creek drainage, Santa Cruz County, Arizona. Critical habitat indicated by cross hatching.



extirpation is highly probable unless conservation efforts are undertaken soon" (Arizona Game and Fish Department 1988).

Sonora chub was included on the U. S. Fish and Wildlife Service (USFWS) Vertebrate Notice of Review in 1982 as a Category 2 species, that is "...taxa that are thought to possibly warrant listing as threatened or endangered, but for which more information is needed to determine their status" (USFWS 1982). It was then proposed (USFWS 1984) and listed (USFWS 1986) under authority of the Endangered Species Act of 1973, as amended, as threatened by the possible introduction of exotic fishes and their parasites into its habitat, and by potential mining activities. It was considered particularly vulnerable to these threats because of its very limited range in the United States, and because of the intermittent nature of Sycamore Creek (USFWS 1986).

Critical habitat was designated at the time of Federal listing to include Sycamore Creek, extending downstream from and including Yanks Spring (=Hank and Yank Spring), to the International border (Figure 2). Also designated was the lower 2.0 km of Peñasco Creek, and the lower 0.4 km of an unnamed stream entering Sycamore Creek from the west, about 2.4 km downstream from Yanks Spring. In addition to the aquatic environment, critical habitat includes a 12-meter-wide riparian area along each side of Sycamore and Peñasco creeks. This riparian zone is believed essential to maintaining the creek ecosystem and stream channels, and to conservation the species (USFWS 1986). U.S. federal regulations do not allow designation of critical habitat in Mexico.

Sonora chub is locally abundant in Sycamore Creek, although the habitat is limited in areal extent (Minckley and Deacon 1968, Maughan 1992). In Mexico, it is found in the rios Magdalena and Altar where it is considered relatively secure (Hendrickson and Juárez-Romero 1990). Much of its biology is unknown

This recovery plan will guide efforts for protection of Sonora chub and management of its habitat. Actions prescribed will be accomplished by various agencies and other groups in consultation with USFWS and according to other laws and regulations that may apply. In the United States the primary agencies will be the Arizona Game and Fish Department (AGFD) and the USDA Forest Service (USFS). Objectives will be attained and necessary funds made available subject to budgetary and other constraints.

Description

Sonora chub was first collected by E. A. Mearns in 1893 from Bear Creek (=Sycamore Canyon) and provisionally identified *as Richardsonius gibbosus (= Gila intermedia)* (Snyder 1915). It was later described (Miller 1945) from specimens collected at several locations in the Rio Magdalena and Sycamore Creek *as Gila ditaenia* and placed in the subgenus *Temeculina* (Miller 1945). This subgenus also includes Yaqui (*Gila purpurea*), arroyo (*Gila orcutti*), and desert chubs (*Gila eremica)* (Miller 1945, DeMarais 1991). No taxonomic changes in its status have been proposed or made since the original description (Barbour and Miller 1978).

Sonora chub is a stream-dwelling member of the minnow family, Cyprinidae, and can achieve total lengths to 200 mm (Hendrickson and Juárez-Romero 1990). In the United States, it typically does not exceed 125 mm (Minckley 1973), although specimens to 150 mm have been measured (J. Carpenter, FWS, pers. comm). It has 63 to 75 scales in the lateral line and the scales bear prominent radii in all fields. The mouth is inferior and almost horizontal. There typically are eight rays in the dorsal, anal and pelvic fins, although the dorsal fin can have nine (Miller 1945), and the anal and pelvic fins seven (Rinne 1976). The body is moderately chubby and dark-colored, with two prominent, black, lateral bands above the lateral *line* (whence *the* specific epithet, *ditaenia)* and a dark, oval basicaudal spot. Breeding individuals are brilliantly colored (Miller 1945), as follows:

> The axils of the pectoral and pelvic fins and the base of the anal fin were brilliant Chinese red, extending out onto these fins about two-thirds of their lengths, leaving a milky border on the outer margins. In some, there was faint evidence of red coloration at the base of rays 3 to 6 of the dorsal fin. The same red color was seen as a bright spot at the comer of the shoulder and also at the comer of the mouth, extending straight back to the posterior edge of the preopercle. The brightest fish were orange on the sides of the belly between the bases of the paired fins, and there was a diffusion of the same color over the ventral part of the caudal peduncle between the anal fin and the origin of the caudal rays. In noting these colors, the sexes were not separated, but the brightest fish were obviously males.
>
> The smaller to medium-sized adults had two prominent, black lateral bands above and below the lateral line the ventral one extending to the base of the anal fin and the dorsal band reaching to the caudal base. The cheeks had a bronze sheen. The general color tone was olivaceous to purplish or almost black above, the lower sides lighter, and the belly white.

Distribution and Abundance

The distribution of Sonora chub appears little changed from its historic range although few collections are available. In the United States, it has remained locally abundant in Sycamore Creek (Minckley and Deacon 1968, Minckley 1973, Minckley 1985), where it occurs in an 8.4-km reach from about 0.1 km below Yanks Spring, downstream to about 1.0 km above the international border (Rob Bettaso, AGFD, pers. comm.). Flow within that reach is intermittent except during the rainy season; surface discharge from Sycamore Creek usually sinks into the stream bed before reaching Mexico (Hendrickson and Juárez-Romero 1990). Other records of occurrence within the Sycamore drainage include Yanks Spring, Peñasco Canyon, Atascosa Canyon, and an unnamed tributary to Sycamore Creek (Bell 1984). Yanks Spring has been impounded in a concrete tank for more than half a century (L. Miller 1949), and contains a population that was introduced from the adjacent creek (Minckley and Brooks 1985).

In Mexico, Sonora chub was first collected from the Rio Magdalena near La Casita in 1940 by Ralph G. Miller, and later that same year near Imuris (Miller 1945). Branson et al. (1960) collected Sonora chub from the Rio Magdalena at a site 1.6 kilometers (one mile) north of San Ignacio. Based on specimens in the Collection of Fishes, Arizona State University, and in the University of Michigan Museum of Zoology, Minckley (1980) plotted sites of occurrence in the rios Magdalena, Altar and Seco. Those sites in the Rio Seco are erroneous and should be disregarded (W. L Minckley, Arizona State University, pers. comm.). Hendrickson (1983) reported continued existence of Sonora chub in Rio Magdalena at Ciénega La Atascosa, near the village of Cirupa.

The Rio de la Concepción drainage was surveyed extensively in 1986. Sonora chub was taken at seven locations in the Rio Magdalena from Trincheras to La Cieneguita, and at one site in Arroyo Cocóspera. In the Rio Altar, Sonora chub was found at six sites from Oquitoa upstream to north of Saric, and two sites in a tributary entering Rio Altar at Saric. The uneven distribution of Sonora chub is probably real--a result of the intermittent nature of the streams and the general aridity of the region (Hendrickson and Juárez-Romero 1990). No flowing surface water was observed in the Rio Seco during an extensive aerial survey in 1986 (Dean A. Hendrickson, University of Texas at Austin pers. comm.), and stock tanks sampled contained only tiger salamander (*Ambystoma tigrinum*), or invertebrates (Hendrickson and Juárez-Romero 1990).

Sonora chub is the only native fish in Sycamore Creek (Minckley 1985). Nonnative green sunfish (*Lepomis cyanellus*), has been found in Sycamore Creek below the entrance of Pefiasco Canyon (Brooks 1982). Golden shiner (*Notemigonus crysoleucas*), and green sunfish have been taken from stock tanks in Sycamore drainage (Will Hayes, AGFD, pers. comm.). Mosquitofish (*Gambusia affinis*), has been reported from Peñasco Creek (Bell 1984).

In Sonora, Hendrickson and Juárez-Romero (1990) collected native longfin dace and topminnow (*Poeciliopsis* spp.) in sympatry with Sonora chub, and nonnative goldfish (*Carassius auratus*), green sunfish, bluegill (*Lepomois macrochirus*), largemouth bass, (*Micropterus salmoides*), channel catfish (*Ictalurus punctatus*), black bullhead (*Ameiurus*

melas), and tilapia (*Oreochromis* sp.). The nonnative fishes were rare in undisturbed habitats within the drainage, but were abundant in reservoirs and in highly altered lotic habitats. Sonora chub was rare where nonnative predators were abundant.

Sonora chub, an undescribed chub (*Gila* sp.) originally reported as an introduced population of Yaqui chub, and apparent hybrid individuals were recorded in Citnega la Atascosa (Hendrickson 1983), although subsequent collections have contained only Sonora chub. Examination of previous collections verified the presence of *Gila* sp. (and hybrids) in Rio Magdalena as early as 1971. Geographic extent of hybrid influences are unknown but appear limited (Hendrickson and Juárez-Romero 1990, DeMarais and Minckley 1992).

Nonnative green sunfish, largemouth bass, and black bullhead probably prey on Sonora chub, but these species usually consist of a small component of the fish community (Brooks 1982, Hendrickson and Juárez-Romero 1990). Seasonal flash-flooding probably keeps the normative fishes from becoming established in canyon-bound reaches (Minckley and Meffe 1987). During intensive visual surveys in 1990 and 1991, Sonora chub was the only fish species seen throughout Sycamore Creek (Carpenter 1992). Other species that presumably prey on chub include coati (*Nasua narica*), raccoon (*Procyon lotor*), belted kingfisher (*Ceryle alcyon*), herons (Ardeidae), garter snakes (*Thamnophis* spp.), giant water bugs and other large predaceous insects, amphibians such as native Tarahumara frog (*Rana tarahumarae*), now extirpated in the United States (Hale and Jarchow 1988), and the common nonnative bullfrog (*Rana catesbeiana*).

Life History

Information on ecology and biology of Sonora chub is incomplete. Based on collection dates of young-of-the-year, spawning occurs in early spring (Minckley 1973). Larval and juvenile Sonora chub were found in Sycamore Creek and in a tributary to Rio Altar in November, however, which indicated breeding was apparently not limited by season. Adults with-breeding coloration were also taken during these periods (Hendrickson and Juárez-Romero 1990). In Sycamore Creek, adults with breeding colors were seen from April through September in 1990 and 1991. Larvae and juveniles (15 to 18 mm) were seen in April, May, and September (Carpenter 1992) suggesting that spawning occurred after the spring and summer rains. Bell (1984) also noted young after heavy flooding, and suggested that post-flood spawning is a survival mechanism evolved by this species.

No data are available on preferred spawning sites, fecundity, larval survival and recruitment, growth, or dispersal. Length frequency distributions showed variation among populations in size-class strength, a possible result of multiple spawnings in a year (Hendrickson and Juárez-Romero 1990).

The only information on food habits was based on examination of stomachs of a few individuals collected in early summer from Sycamore Creek In decreasing order of volume, food consisted of aquatic and terrestrial insects, and algae. Like other chubs,

Sonora chub is probably an opportunistic feeder that takes advantage of seasonally available resources (Minckley 1973).

Habitat in Sycamore Creek is much more limited than in Sonora, In Sycamore Creek, Sonora chub is more likely in the largest, deepest, most permanent pools (Carpenter 1992). Analysis of habitat use by Sonora chub showed the variables that best discriminate between pools that support fish through the summer, and pools that do not, are maximum depth, percent of decrease in maximum depth, substrate type, and the amount of floating cover. Intercomrectedness of persistent vs. ephemeral habitats during high water levels may also be a factor affecting habitat suitability (Carpenter 1992).

In Mexico, the bulk of the collection by Ralph G. Miller was made in a one-meter deep pool formed by the roots of a fallen tree (Miller 1945). In other samples, Sonora chub was not randomly distributed, but was concentrated in deeper areas and under cover. Preferred cover reportedly is fallen logs, areas of dense aquatic vegetation, *Rorripa acuaticum*, and undercut rootmasses. These forms of cover were used if associated with intermediate to low current velocity. The species was noticeably less abundant where current velocity was high, though apparently adequate protection was present (Hendrickson and Juárez-Romero 1990).

Sonora chub also shows a preference for stream habitats, while the undescribed chub appears restricted to spring- and seepage-fed marshes, or ciénegas (DeMarais and

Minckley 1992). Catch of Sonora chub per unit of effort was high in sites where flow and velocities were high, and substrates coarse. In sites dominated by current-free pools with organic sediments, catch rates of Sonora chub were significantly lower, however, all collections of *Gila* sp. came from this habitat type (Hendrickson and Juárez-Romero 1990).

In most instances, Sonora chub is abundant to common within its occupied habitat (Hendrickson and Juárez-Romero 1990, Carpenter 1992). In streams in Sonora, small Sonora chub were found in ephemeral habitats near perennial reaches where larger individuals dwelt (Hendrickson and Juárez-Romero 1990). In Sycamore Creek, this same behavior resulted in the loss of these smaller individuals through desiccation or predation as stream flow decreased (Carpenter 1992). The species evidently maintains a population through use of perennially watered reaches during droughts and is redistributed by dispersal of smaller individuals during periods of greater discharge (Hendrickson and Juárez-Romero 1990).

Sonora chub is a tenacious, desert adapted species, adept at exploiting small marginal habitats (Hendrickson and Juárez-Romero 1990), and can survive under severe environmental conditions. Over time, it has evidently developed means to cope with stochastic natural events such as droughts, floods, fires, pathogens, etc. For example, a tiny population of dwarfed individuals was once located in a cattle-trampled seep north of

Yanks Spring and had survived in a few liters of stagnant water that was overgrown with vegetation (Minckley 1973).

Little information is available on parasites and diseases of Sonora chub. In the rios Altar and Magdalena, infestations of Sonora chub by a nematode, tentatively *Eustrongylides* sp., were noted (Hendrickson and Juárez-Romero 1990).

Reasons for Decline

Distribution of Sonora chub in the United States is intact and should remain secure, barring major environmental change (C.O. Minckley 1983, Minckley 1985). In Mexico, the native ichthyofauna of the Rio de la Concepción drainage, including Sonora chub, was reported secure. Nonetheless, hybridization between Sonora chub and *Gila* sp. might prove a threat if introgression occurs into adjacent populations (Hendrickson 1983, Hendrickson and Juárez-Romero 1990, DeMarais and Minckley 1992).

The limited distribution of Sonora chub in the United States places inordinate importance on the quality of habitat in Sycamore Creek The Sycamore drainage has been highly modified by human activities, indluding grazing, mining, recreation, and the introduction of exotic taxa. It regularly sustain large floods and severe droughts, and tie is always a possibility. Sycamore Creek is at the edge of the range of the species, is isolated from other populations of Sonora chub, and has marginal habitat (Hendrickson and Juárez-Romero 1990). A series of environmental perturbations made worse by degraded watershed conditions could cumulatively result in extirpation of the species from the United States.

Native fishes appear adept at maintaining populations during severe conditions so long as their habitats are unaltered (Minckley and Meffe 1987). Thus, a single catastrophic event, such as severe flood, fire or drought, is unlikely to eliminate Sonora chub from the United

States. However, floods in combination with other catastrophic events, such as wildfire, have caused the loss of isolated fish populations in other areas (Propst et al. 1992, John Rinne, USFS, pers. comm.). Hale and Jarchow (1988) documented the recent and sudden extirpation of Tarahumara frog from the United States (including Sycamore Canyon). The cause of that extirpation was thought to be an environmental toxicant, possibly associated with acid precipitation.

The importance of a stable, undisturbed watershed for maintaining the environment cannot be overstated. Channel degradation, siltation, and water pollution caused primarily by livestock grazing, roads, and mining have probably affected the habitat of Sonora chub. No specific data are available for Sycamore drainage, but degradation of soil and water caused by mining and livestock grazing is well documented in adjacent watersheds. Livestock grazing has accelerated runoff and erosion and reduced infiltration, mining has increased sedimentation and reduced water quality, and roads have concentrated runoff in nearby drainages (Hastings 1959, Hastings and Turner 1965, Cooke and Reeves 1976, Bahre and Bradbury 1978, Hendrickson and Minckley 1985). In other streams in the Southwest, spillage from mines and tailings ponds has eliminated fish and other aquatic biota (Jackson et al. 1987).

In Sonora, streams in the upper Rio de la Concepción basin are generally unmodified by human activities. Sonora chub has been only locally affected by habitat modifications,

principally small reservoirs and diversions. However, one large impoundment in the Rio Altar has desiccated a long reach of stream, and caused fish habitat to be lost (Hendrickson and Juárez-Romero 1990).

Potential threats to Sonora chub are related to additional watershed development. Increased grazing and mining operations in upstream watersheds could result in increased siltation and runoff, increased water demand and withdrawal, and introduce pollutants to the stream. Cattle regularly gain access to Sycamore Canyon through an unmaintained section of fence along the international border (Tom Deecken, Coronado National Forest, pers. comm.) and degrade the riparian vegetation in the lower 4.0 kilometers (2.5 miles) of the stream (Carpenter 1992). Livestock grazing in riparian areas is usually detrimental to fish habitat.

Exploration for uranium occurred in 1981 on the upper eastern slopes of the Sycamore drainage on mining claims occupying 10 to 13 square kilometers (6.2 to 8.1 miles). Uranium was found and the claims are being maintained; however, no active mining is presently planned (USFWS 1986). Mining is active in California Gulch, a drainage 4.8 kilometers (3.0 miles) west of Sycamore Canyon (USFWS 1986). The USFS has received proposals for expansion of tailings ponds and other related developments in that area (Tom Deecken, Coronado National Forest, pers. comm.).

Long reaches of the lower Rio de la Concepción may have supported Sonora chub, but have been dried by impoundment, diversion, and pumping (Hendrickson and Juárez-Romero 1990). The chronic effects of these land uses can result in the slow, inexorable loss of conditions suitable for survival and reproduction of Sonora chub. They also can intensify the effects of natural events to the extent that native fishes are eliminated.

Predation by nonnative vertebrates is also a threat to populations of Sonora chub. Green sunfish is a known predator on native fishes in Arizona (Minckley 1973), and has been implicated in population changes in other lotic fish communities (AGFD 1988). Hendrickson and Juárez-Romero (1990) noted smaller populations of Sonora chub in areas where normative fishes were present. Sonora chub was absent when normative predators were abundant in reservoirs and highly modified stream habitats. Bullfrogs, common in watersheds adjacent to Sycamore Creek, have also been implicated in the disappearance of native frogs and fishes in western aquatic habitats (AGFD 1988).

Coincidental introductions of exotic parasites that infest native faunas is possible when nonnative fishes are brought into a drainage. The effects these parasites may have on a fish fauna not previously adapted to them is unknown, but probably adverse (Hendrickson and Juárez-Romero 1990).

Conservation Efforts

Conservation measures provided to species listed as endangered or threatened under the Endangered Species Act (Act) include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing encourages conservation actions by Federal, State and private agencies, groups, and individuals. ´ Section 7(a) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species or to destroy or adversely modify its critical habitat (USFWS 1986).

All waters occupied by the species in the United States are within Coronado National Forest and about one-half of the drainage is within Pajarita Wilderness and Goodding Research Natural Area (RNA). These special designations were placed on the area because it had a biological community characterized by Mexican floral and faunal elements that did not otherwise occur, or were elsewhere rare, in the United States (Goodding 1961, Curran 1973, Smith 1984, USFS 1988b). Management direction for these special units is to maintain the area in climax vegetation. Removal of minerals, livestock grazing, use of motorized vehicles, and harvest of timber or fuelwood is not permitted, and recreation is limited to non-developed and dispersed use. Livestock grazing is permitted within Pajarita Wilderness outside of Goodding RNA The remainder of Sycamore drainage and California Gulch is open to multiple uses (USFS 1988a).

Sycamore Canyon receives considerable visitor use, particularly in the riparian area. Hikers and campers desiring to view plants and animals normally associated with habitats in Mexico are drawn to the area. Yanks Spring is the site of a parking area for trailhead access into Sycamore Canyon (USFS 1988a, 1988b). Existing management of these areas was considered compatible with critical habitat designation. Federal activities were not expected to affect, or be affected by, the critical habitat designation (USFWS 1986).

When the Sonora chub was Federally listed, a special rule giving the State authority for regulating "take" was issued. This rule allowed for more efficient management of the species, and thus enhanced conservation efforts for Sonora chub. Because Sonora chub was threatened primarily by habitat disturbance or alteration and not by intentional, direct taking of individuals, the special rule allowed the State to regulate or permit take of individuals for certain conservation purposes. If a State scientific collecting permit was obtained, and all other wildlife conservation laws and regulations satisfied, a Federal permit was not needed to take Sonora chub (USFWS 1986).

This special rule also acknowledged that incidental take of Sonora chub by State-licensed recreational anglers posed no threat to the species. If the angler immediately returned the individual fish to its habitat, there would be no violation of the Act (USFWS 1986).

Since Federal listing, several activities have been undertaken for the conservation of Sonora chub. The State reclassified the species as Endangered (AGFD 1988), an extensive

survey of streams in the Rio de la Concepción drainage was accomplished (Hendrickson and Juárez-Romero 1990), and a study detailing macrohabitat and microhabitat requirements of Sonora chub was completed (Carpenter 1992). Goodding RNA was expanded to include all of Sycamore Creek that supported Sonora chub (USFS 1988a). The USFS is exploring ways to assume responsibility for fenceline maintenance along the international border in Sycamore Canyon (Randall Smith, Coronado National Forest, pers. comm.).

II. RECOVERY

Objective

This recovery plan will guide management actions to conserve Sonora chub in its natural habitat. At the time of listing the Sonora chub was considered threatened by the possible introduction' of exotic fishes and their parasites into its habitat, and by potential mining activities. It continues to be particularly vulnerable to those threats because of its limited range and the intermittent nature of Sycamore Creek, the only stream it occupies in the United States.

In the United States, the probability of securing of Sonora chub maybe enhanced owing to Federal land ownership and the special-use designations in Sycamore Canyon Efforts in the United States will consist of managing the Sycamore Creek drainage for conservation of Sonora chub and other native species, monitoring the population of Sonora chub and its habitat, and studies to help understand its biology. Similar protection will be necessary in Mexico to prevent local extirpation of the species.

Delisting the species is unlikely. Habitat in the United States is limited to Sycamore Creek where the status of Sonora chub will remain precarious due to the dynamic nature of the environment. Habitat in Mexico is also limited, and modification of watercourses and dewatering of the streams will be a continuing threat.

Narrative Outline

I. PROTECT REMAINING POPULATIONS OF SONORA CHUB.

Remaining populations of Sonora chub continue to be threatened by non-native fishes, alteration of habitat by various land uses, and inadequacy of existing regulations. Remaining populations must be protected to safeguard the species from extinction.

A. RECOGNIZE CRITICAL HABITAT,

Critical habitat in the United States was designated for Sonora chub in Sycamore drainage, starting from and including Yanks Spring, downstream along Sycamore Creek to the international border with Mexico. Also included were the lower 2.0 km of Peñasco Creek, and the lower 0.4 km of an unnamed stream that enters Sycamore Creek from the west in the northwest 1/4 of Section 23, Township 23 South, Range 11 East.

Critical habitat included a twelve-meter wide riparian area along each side of Sycamore and Peñasco creeks. This riparian zone was considered essential to the maintenance of the creek ecosystem and the stream channels, and to the conservation of the species. No riparian zone was designated around Yanks Spring because it was impounded in a concrete tank. No riparian zone was designated for the unnamed stream because this reach

consisted of bedrock pools that were unaffected by the riparian zone. All of the area is located within Coronado National Forest.

The effects of on-going and proposed land use activities on critical habitat need to be assessed and documented according to Endangered Species Act requirements. The USFS, in consultation with the USFWS, should determine effects of any land use activities on Sonora chub or its critical habitat. In particular, any proposal for extraction of minerals from tributaries of the Rio Altar in the United States should be closely scrutinized for effects on downstream habitats of Sonora chub. Other activities, such as livestock grazing, road construction or maintenance, and recreational development need to be analyzed for effects on critical habitat.

B. REMOVE NONNATIVE FISHES.

The presence of nonnative and competing fishes in Sycamore drainage poses a continuing threat to Sonora chub. Green sunfish and other normative fishes must be removed from stock tanks in Sycamore Canyon to prevent them from being washed into Sycamore Creek during floods or by unauthorized transplants. Flooding has appeared to restrict normative fishes from becoming established in Sycamore Creek; however, a series of years without floods could allow the establishment of a large enough population of normative species to impact the threatened chub.

The fish community in Sycamore Creek should be monitored annually to document relative abundance of nonnative species. The Desert Fishes Recovery Team should be provided these data and may recommend removal of nonnative taxa should they increase to a point where survival of Sonora chub is threatened. Removal of nonnative species by means that are also harmful to Sonora chub (e.g., piscicides) should be done only after careful consideration. This method may be appropriate only if natural recovery of Sonora chub is unlikely. Regulations prohibiting the introduction of normative fishes or other aquatic organisms into stock tanks or streams in the Sycamore drainage should be promulgated by A G F D .

In Mexico, plans should be prepared and efforts implemented to control or remove nonnative fishes in habitats vital to continued consevation of Sonora chub. Recovery efforts should be closely coordinated by the responsible agencies in Mexico to ensure success and support by the local populace.

C. DETERMINE WATER USE PATTERNS AND PROTECT WATER RIGHTS.

Continued maintenance of habitat for Sonora chub depends upon assured water flow. A record search should be made to determine if any water rights in Sycamore drainage exist. Any water rights that could affect Sonora chub should be either purchased, withdrawn, or otherwise acquired. A study should be conducted of expected water use patterns in the drainage. The USFS or AGFD should apply for water rights to instream flows in

Sycamore Creek Methods to protect instream flows in the Rio de la Concepción in Mexico should be investigated.

D. INCORPORATE SONORA CHUB MANAGEMENT NEEDS INTO MANAGEMENT PLANS FOR GOODDING RNA AND PAJARITA WILDERNESS.

Current management direction by the USFS provides that Goodding RNA and Pajarita Wilderness will be managed to maintain climax conditions. The USFS, USFWS, and AGFD should jointly review existing policies and plans for Sycamore drainage and make any changes that are needed for the continued existence of Sonora chub and other listed species that may occur in the area.

A management position that incorporates the various rules, policies, and philosophies about endangered species, Research Natural Areas and Wilderness is needed to define allowable actions. This statement is needed to reduce conflicts between agencies and personnel who may have differing management goals or philosophies.

E. ENSURE HABITAT INTEGRITY.

Agencies with jurisdiction over activities that could modify the existing habitat should be kept informed of the status of the Sonora chub, its distribution, and needs. New information gained through research or monitoring should be disseminated to the agencies

for their use in formulating management plans and assessing effects of proposed activities. In the United States, Endangered Species Act consultation requirements mandate that Federal project specifications preclude any action that may jeopardize the continued existence of any listed species. The USFS should ensure that any activities in Sycamore drainage do not affect the continued existence of Sonora chub or adversely modify its critical habitat.

Critical habitat of Sonora chub is within Goodding RNA and Pajarita Wilderness, which are protected from inappropriate land uses. However, the watershed surrounding these special areas is open to permitted multiple uses, including livestock grazing, mineral exploration and removal, dispersed recreation and roads. The stability of the soil and water resources of this watershed has significant effect on instream and riparian conditions in Sycamore Creek Therefore, management guidelines should be established that will ensure the integrity of the area.

In particular, mining activities in Sycamore Canyon and California Gulch must be given careful consideration regarding their effects on downstream habitats of Sonora chub. Grazing allotments should be under management systems designed to enhance watershed stability. Roads should be constructed and maintained to avoid excessive surface erosion. Dispersed recreation around Yanks Spring should be managed to a level that will prevent excessive degradation of the riparian resources.

Livestock grazing in upper Sycamore Canyon should be examined to determine if watershed conditions are being affected to the detriment of Sonora chub. The overall management scheme for the allotment(s), including season of use, utilization, stocking rates, and cattle movement needs to be examined (and recommendations enforced) to determine if proper watershed conditions are being maintained.

Trespass cattle in the lower end of Sycamore Canyon degrade riparian conditions and habitat availability for Sonora chub. Currently, maintenance responsibility for the fence along the International border lies with the International Boundary and Water Commission, whose goals are identification of the border and not natural resource protection. The USFS should assume responsibility for maintenance of the fenceline for the purpose of resource management.

Avenues for land protection in Mexico, such as conservation areas, should be explored to protect habitats of Sonora chub that are especially important for its survival. Responsible agencies and conservation groups should be encouraged to work with the local landowners to foster an understanding of the special needs of the Sonora chub, and to protect its habitat from degradation through land protection. The Centro Ecológico de Sonora should lead this effort.

F. SURVEY ALL EXISTING AND POTENTIAL HABITATS.

Extensive surveys in the Rio de la Concepción drainage should be done to determine if additional populations of Sonora chub exist, or if there are suitable stream habitats in which populations of Sonora chub could be established. Gaps in distribution in the rios Magdalena and Altar need to be thoroughly documented. In the United States, Tonto Canyon, California Gulch and Warsaw Canyon need to be surveyed for existing or potential habitat for Sonora chub (Bell, 1984).

Proposals for reestablishment of Sonora chub in apparently suitable habitats should follow guidelines established by the American Fisheries Society. In part, those guidelines emphasize restricting introductions to sites that fulfill life history requirements of the species, and that contain enough habitat to support a viable population (Williams et al. 1988). Efforts to reestablish Sonora chub should concentrate on habitats that will maintain a viable population through floods, drought or other stochastic events. Sonora chub should be reestablished only in habitats similar to those used historically by the species. Currently AGFD is evaluating several sites in Sycamore Canyon for re-establishment of Sonora chub.

II. MONITOR AND ASSESS POPULATION AND HABITAT DYNAMICS.

Fish populations typically experience wide fluctuations in abundance and year-class strength that are often, but not always, caused by variations in habitat quality and quantity. Few data are available to determine extent of normal variation in population abundance of Sonora chub or its habitat parameters. Cause and effect relationships between habitat and population parameters need to be determined. This information is needed to determine long-term trends in abundance and to assess short-term perturbations to the habitat that may influence the continued survival of Sonora chub.

A. ESTABLISH STANDARDIZED MONITORING TECHNIQUES FOR FISH AND HABITAT.

To ensure long term value of monitoring data, AGFD, USFS, USFWS, and Arizona Department of Environmental Quality should standardize monitoring methodologies and cooperate in conducting monitoring in Sycamore Creek Monitoring should be done at several established stations that together represent the range of habitat types typically occupied by the species. Monitoring should be done at least twice a year for the first five years, during late-June, before summer rains, and again in autumn, when conditions have stabilized after *summer* rains. The late-June surveys would provide information on which areas and populations are permanent, and degree of habitat loss due to drought. It also would provide information on size-class structures of populations that survived the winter. The autumn surveys would provide information on spawning and survival after flooding.

Capture and holding techniques should be designed to reduce stress on individual fish. Enough individuals should be captured during each monitoring effort to provide an accurate assessment of the size and age structure of the population.

Habitat characteristics should be classified at each site, and selected parameters measured. Monitoring of habitat conditions should be concurrent with population monitoring, and current methods for habitat classifying and riparian condition classification applied. In addition to riparian monitoring, the watershed condition in Sycamore drainage should be determined and an analysis made of the watershed 's ability to maintain living conditions for Sonora chub.

An analysis of each monitoring effort should be made, and copies provided to each of the participating agencies. A permanent file of monitoring results and field data sheets should be maintained by AGF'D. After five years, an assessment of the results should be made to determine the schedule for future monitoring.

Centro Ecológico de Sonora, or other appropriate agency, should be encouraged to take responsibility for monitoring Sonora chub populations. Techniques and timing of monitoring in streams in Sonora should correspond to those used in Arizona. Cooperative efforts should be made by biologists and agencies from the United States and Mexico to gather data on Sonora chub in all its habitats.

B. ASSESS POPULATION DYNAMICS.

A thorough understanding of the biology of Sonora chub is necessary if survival of the species is to be assured. A database of current biological information is vital if unforeseen, adverse events that might require rapid management action occur. Various academic institutions, private consultants and agency personnel are available to conduct research and monitoring that will generate these data. AGFD should take the lead for monitoring population dynamics in Sycamore Creek with USFWS and USFS in an advisory capacity. In Mexico, Centro Ecológico de Sonora, or other appropriate agency, should monitor the populations. AGFD, USFWS, and USFS should cooperate in the funding of these studies in the United States and should explore international avenues to accomplish the same in Mexico.

1. DETER[redacted]EPRODUCTIVE VARIABLES.

Knowledge of the reproductive biology of Sonora chub is needed to develop a reproductive profile that could contribute to the perpetuation and enhancement of the species.

2. DETERMINE EFFECTS OF PREDATION AND COMPETITION.

Green sunfish have been linked to declines of many native fish communities in small streams. Predation or competition by green sunfish should be monitored to determine if this has a significant detrimental effect on Sonora chub. The occurrence of other non-native species, including golden shiner and mosquitofish, and their effects on Sonora chub should be monitored. These data can be used to determine if or when removal of nonnative species is warranted.

3. DETERMINE SURVIVORSHIP BY AGE GROUP.

Survivorship curves by age group of Sonora chub has not been documented. Mortality rates for each life history stage should be determined and incorporated into a species management plan

4. DETERMINE DISEASE AND PARASITES.

No data are available on diseases and parasites that may infect Sonora chub. As Sonora chub occupies a limited *range,* an epidemic could seriously affect its chances for survival. Advanced knowledge of pathogens and Sonoran chub susceptibility is vital to containing an epidemic and to establishment of captive populations.

5. DETERMINE DIEL, SEASONAL, AND ANNUAL DISTRIBUTION OF LIFE STAGES.

To understand habitat needs of Sonora chub, knowledge of its diel, seasonal, and annual distribution is required. Use by life stage of the various habitat types existing in occupied range should be determined.

6. DETERMINE OTHER FACTORS PERTINENT TO PERPETUATION OF SONORA CHUB.

Observations on behavior (including interactions with other species), physiological responses, diet, and other biological attributes of Sonora chub should be recorded during monitoring and other studies. This information can contribute to the accumulation of basic information applicable to management.

C. ASSESS HABITAT DYNAMICS.

Survival of Sonora chub depends on availability and condition of habitat. The limited range of Sonora chub in Arizona places inordinate importance on ensuring the integrity of riparian conditions in Sycamore drainage. Surveys and analysis of physical, chemical, and biological features of existing habitat in relation to abundance and distribution of Sonora chub can provide insight regarding preferred habitat.

Aquatic habitat conditions in Sycamore Creek fluctate according to weather patterns and hydrologic cycle. Sonora chub, both individually and as a population, must live with the changing conditions. Variability within measured habitat parameters, and their relationships with population dynamics, should be determined to define habitat for Sonora chub and provide direction for land management.

The amount of habitat available to the Sonora chub, its use of that habitat, and habitat factors limiting the population need to be assessed. Studies should be conducted to describe physical, chemical, and biological features that comprise the habitats of Sonora chub. Identification of terrestrial and aquatic flora and fauna associated with occupied habitat need to be included. An evaluation of diel, seasonal, and annual habitat availability will assist comprehension of seasonal and daily needs of Sonora chub in relation to available habitat. The USFS should take the lead in assessing habitat conditions for Sonora chub in Sycamore Canyon with the AGFD and USFWS serving in an advisory capacity.

Assessment of habitat dynamics in Sycamore Canyon will not be directly applicable to habitats in the rios Magdalena and Altar. Sycamore Canyon is on the periphery of the species range and is not typical of habitat within the bulk of the range. Therefore, it is important for conservation of both United States and Mexican populations of Sonora chub to conduct habitat assessments in the rios Magdalena and Altar. The Centro Ecológico de Sonora should be encouraged to lead his effort.

1. DETERMINE FISH-HABITAT RELATIONSHIPS.

The relationships between occurrence of Sonora chub and various habitat parameters (e.g., water velocity, depth, substrate, overhead and instream cover, habitat type, etc.) should be determined to provide an understanding of the species' preferred habitat. This knowledge can then be applied to assess the effects of other land use activities on the habitat.

2. DETERMINE PRECIPITATION-RUNOFF RELATIONSHIPS.

To manage habitat of Sonora chub effectively, the precipitation-runoff relationship within the watershed should be monitored. Data from strategically located rain gauges and water level recorders can be compared to determine how localized precipitation events influence stream flow and the effect of sediment loading on Sonora chub habitat. This information will be especially important as baseline data upon which recovery of the land from past human uses can be measured. A study of the drainage's capacity to store and release water over time should be designed and accomplished.

3. EVALUATE RELATIONSHIPS OF RUNOFF-INSTREAM FLOW NEEDS.

The effects land uses have on daily discharge in Sycamore Creek should be evaluated. Practices that result in highly erosive floods that deliver large amounts of sediment should be curtailed and replaced with those that enhance stability of the hydrograph.

III. MAINTAIN CAPTIVE RESERVES OF SONORA CHUB.

The limited distribution of Sonora chub makes its survival precarious. A catastrophic event in any area could eliminate a population and reduce the genetic variability of the species. Efforts should be made to reduce the potential for loss of any genetic material. Captive reserve populations of each distinct type should be kept at suitable facilities in the United States and Mexico.

A. ESTABLISH CAPTIVE RESERVE POPULATIONS.

A captive population of each genetically identifiable stock should be maintained at suitable facilities in the United States and Mexico. These populations should be periodically supplemented with wild fish to ensure maintenance of genetic heterozygosity. The stocks also should be checked electrophoretically every 10 years to verify their genetic integrity. Offspring from these stocks can be made available for various other studies.

Sonora chub from Sycamore Creek are currently maintained at Arizona-Sonora Desert Museum in Tucson, and Centro Ecológico de Sonora in Hermosillo holds stock from streams in Mexico. Continued maintenance of these stocks should be encouraged. Sonora chub appears relatively easy to maintain in captivity, and efforts should be made to encourage other zoos or museums to hold populations. Desert Fishes Recovery Team should review and recommend any applications for captive populations.

B. DETERMINE THE GENETIC VARIABILITY OF THE SPECIES.

To maintain genetic diversity in a captive stock of Sonora chub, it is necessary to first determine the genetic composition of existing wild stocks. A complete genetic analysis of fish from the rios Altar and Magdalena and Sycamore Creek should be conducted to determine genetic composition within populations and if any detectable genetic differentiation exists between the populations. In addition, a study should determine if any morphometric differences between populations exist.

IV. PRODUCE INFORMATION FOR PUBLIC EDUCATION IN THE UNITED STATES AND MÉXICO.

An important part of any recovery effort is public support. This support can be gamed through an active public information and education program.

A. PRODUCE AN INFORMATION PAMPHLET,

A fact sheet type of pamphlet in Spanish and English should be produced and made available for distribution to the public. This pamphlet should present information on the biology of Sonora chub, threats to its survival, and status of recovery efforts.

B. ISSUE NEWS RELEASES.

Periodic news releases concerning efforts for recovery for Sonora chub should be made available to the news media in the United States and Mexico.

C. DEVELOP AND CONDUCT INTERPRETIVE PROGRAMS.

In Arizona, most of the habitat of Sonora chub is within Goodding RNA and Pajarita Wilderness where there is an opportunity to conduct an interpretive program that would make users of the area aware of the fish and its uniqueness. The trailbead at Yanks

Spring receives considerable use from recreationists and would be a suitable location to interpret the natural ecology of Sycamore Canyon, including Sonora chub. The "Eyes on Wildlife" program of the USFS is a good vehicle to accomplish this. Agencies in México should be encouraged to develop a similar program.

D. PROVIDE STATUS INFORMATION TO INTERESTED PARTIES.

Federal and State enforcement agencies must be kept informed of the legal status of the Sonora chub and its habitat. Assistance should be provided to these agencies so they may properly identify the species and know where it occurs.

Literature Cited

Arizona Game and Fish Commission. 1982. Threatened Native Wildlife in Arizona. Arizona Game and Fish Department Publication, Phoenix. 12 pp.

Arizona Game and Fish Department. 1988. Threatened native wildlife in Arizona. Arizona Game and Fish Department, Phoenix. 32 pp.

Bahre, C. J. and D. E. Bradbury. 1978. Vegetation change along the Arizona-Sonora boundary. Annals of the Association of American Geographers 68:145-165.

Barbour, C. D. and R. R. Miller. 1978. A revision of the Mexican cyprinid fish genus *Algarisea*. Miscellaneous Publications, Museum of Zoology, University of Michigan No. 155. 72 pp.

Bell, G. 1984. Sonora chub, Sycamore Canyon. Memo, USDA Forest Service, Coronado National Forest, Nogales, AZ. 13 pp.

Branson, B. A, C. J. McCoy, Jr, and M. E. Sisk 1960. Notes on the freshwater fishes of Sonora with an addition to the known fauna. Copeia 1960:217-220.

Brooks, J. E. 1982. Sycamore Creek Survey - *Gila ditaenia*. Inter-office memo, Arizona Game and Fish Department, Phoenix. 2 pp.

Carpenter, J. 1992. Summer habitat use of Sonora chub in Sycamore Creek, Santa Cruz County, Arizona. M.S. Thesis, University of Arizona, Tucson. 83 pp.

Cooke, R. U. and R. W. Reeves. 1976. Arroyos and Environmental Change in the American Southwest. Oxford University Press, London.

DeMarais, B. D. 1991. *Gila eremica*, a new cyprinid fish from northwestern Sonora, Mexico. Copeia 1991: 178-189.

DeMarais, B. D. and W. L Minckley. 1992. Hybridization in native cyprinid fishes, *Gila ditaenia* and *Gila* sp., in northwestern Mexico. Copeia 1992:697-703.

Curran, N. L 1973. Goodding Research Natural Area. Report, USDA Forest Service, Coronado National Forest, Nogales, AZ. 30 pp.

Goodding, L N. 1961. Why Sycamore Canyon in Santa Cruz County should be preserved as a nature sanctuary or natural area. Journal of the Arizona Academy of Science 1:113-115.

Hale, S. F. and J. L. Jarchow. 1988. The status of the Tarahumara frog (*Rana tarahumarae*) in the United States and Mexico. Part II. Report, Arizona Game and Fish Department, Phoenix. 101 pp.

Hastings, J. R. 1959. Vegetation change and arroyo cutting in southeastern Arizona. Journal of the Arizona Academy of Science 1:60-67.

Hastings, J. R. and R. M. Turner. 1965. The changing mile. University of Arizona Press, Tucson 371 pp.

Hendrickson, D. A. 1983. Distribution records of native and exotic fishes in Pacific drainages of northern Mexico. Journal of the Arizona-Nevada Academy of Science 18:33-38.

Hendrickson, D. A. and L. Juárez-Romero. 1990. Los peces de la cuenca del Rio de la Concepción, Sonora, Mexico, y el estatus del charalito sonorense, *Gila ditaenia*, una especie en amenaza de extincion. Southwestern Naturalist 35:177-187.

Hendrickson, D. A. and W. L Minckley. 1985. Ciénegas -- Vanishing climax communities of the American Southwest. Desert Plants 6:131-175.

Jackson, W., T. Martinez, P. Cuplin, et al. 1987. Assessment of water conditions and management opportunities in support of riparian values: BLM San Pedro River Properties, Arizona. Project Completion Report. USDI Bureau of Land Management, Service Center, Denver, CO. 151 pp. + appendices.

Miller, L 1949. Field notes on *the minnow, Gila ditaenia,* in southern Arizona. Copeia 1949: 148-150.

Miller, R. R. 1945. A new cyprinid fish from southern Arizona and Sonora, Mexico, with a description of a new subgenus of *Gila* and a review of related species. Copeia 1945:104-110.

Miller, R. R. and C. H. Lowe. 1967. Part 2. Fishes of Arizona. Pp. 133-151, *In, C.H.* Lowe (ed.). The Vertebrates of Arizona. University of Arizona Press, Tucson.

Minckley, C. 0. 1983. Status report for *Gila ditaenia* (Miller) (Sonora chub). Report prepared for Office of Endangered Species, U. S. Fish and Wildlife Service, Albuquerque, NM. 14 pp.

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

Minckley, W. L 1980. *Gila ditaenia* Miller, Sonora chub. P. 166, *In,* D. S. Lee, et al., (eds.). 1980. Atlas of North American Freshwater Fishes. North Carolina State Museum of Natural History, Raleigh. 854 pp.

Minckley, W. L 1985. Native fishes and natural aquatic habitats in U. S. Fish and Wildlife Service Region II west of the Continental Divide. Report, U. S. Fish and Wildlife Service, Albuquerque. Department of Zoology, Arizona State University, Tempe. 158 pp.

Minckley, W. L and J. E. Brooks. 1985. Transplantations of native Arizona fishes: Records through 1980. Journal of the Arizona-Nevada Academy of Science 20:73-90.

Minckley, W. L and D. E. Brown 1982. Part 6. Wetlands. Pp. 222-287, 333-341, + literature cited, *In,* D. E. Brown (ed.). Biotic Communities of the American Southwest, United States and Mexico. Desert Plants 1-4:4-341.

Minckley, W. L and J. E. Deacon. 1968. Southwestern fishes and the enigma of "endangered species." Science 159:1424-1432.

Mincldey, W. L, D. A. Hendrickson, and C. E. Bond. 1986. Geography of Western North American freshwater fishes: Description and relationships to intracontinental tectonism. Pp. 519-613, + literature cited, *In, C.* J. Hocutt and E. 0. Wiley (eds.), Zoogeography of North American Freshwater Fishes. John Wiley and Sons, Incorporated. New York.

Minckley, W. L and G. K. Meffe. 1987. Differential selection by flooding in stream-fish communities of the arid American southwest. Pp. 93-104, *In,* W. J. Matthews and D. C. Hines (eds.), Community and Evolutionary Ecology of North American Stream Fishes. University of Oklahoma Press, Norman

Page, L M. and B. M. Burr. 1991. Peterson Field Guide Series: Freshwater fishes (North America north of Mexico). Houghton Mifflin Company, Boston. 432 pp.

Propst, D. L, J. A. Stefferud, and P. R. Turner. 1992. Conservation and status of Gila trout, *Oncorhynchus gilae* (Miller). Southwestern Naturalist 37:117-125.

Rinne, J. N. 1976. Cyprinid fishes of the genus *Gila* from the lower Colorado River basin. The Wasmann Journal of Biology 34:65-107.

Silvey, W., J. N. Rinne, and R. Sorenson. 1984. Index to the natural drainage systems of Arizona-A computer compatible digital identification of perennial lotic waters. USDA Forest Service, Southwestern Region, Wildlife Unit Technical Report. Albuquerque. 36 pp.

Smith, E. L 1984. Goodding Research Natural Area. *In,* Established natural areas in Arizona, a guidebook for scientists and educators. Arizona Academy of Sciences. Planning Division., Economic Planning and Development Office, Office of the Governor, Phoenix.

Snyder, J. 0. 1915. Notes on a collection of fishes made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California. Proceedings of the United States National Museum 49:573-586.

U. S. Fish and Wildlife Service. 1982. Endangered and threatened wildlife and plants; vertebrate notice of review. Federal Register 47:58454.

U. S. Fish and Wildlife Service. 1984. Endangered and threatened wildlife and plants; proposed rule to determine the Sonora chub to be a threatened species and to determine its critical habitat. Federal Register 49:23402.

U. S. Fish and Wildlife Service. 1986. Endangered and threatened wildlife and plants; final rule to determine the Sonora chub to be a threatened species and to determine its critical habitat. Federal Register 51:16042-16047.

USDA Forest Service. 1988a. Coronado National Forest Plan. USDA Forest Service, Coronado National Forest, Tucson, AZ. Pp. 130.

USDA Forest Service. 1988b. Establishment record for the Goodding Research Natural Area within the Coronado National Forest, Santa Cruz County, Arizona. USDA Forest Service, Coronado National Forest, Tucson, Arizona Pp. 17 + appendices. Reproduced.

Williams, J. E., D. B. Bowman, J. E. Brooks, et al. 1985. Endangered aquatic ecosystems in North American deserts with a list of vanishing fishes of the region. Journal of the Arizona-Nevada Academy of Science 20:1-62.

Williams, J. E., D. W. Sada, C. D. Williams, et al. 1988. American Fisheries Society Guidelines for introductions of threatened and endangered fishes. Fisheries 13(5):5-11.

Williams, J. E., J. E. Johnson., D. A. Hendrickson, et al. 1989. Fishes of North America endangered, threatened, or of special concern: 1989. Fisheries 14(6):2-20.

III. IMPLEMENTATION SCHEDULE

Definition of Priorities

Priority 1 - Those actions that are absolutely essential to prevent the extinction of the species in the foreseeable future.

Priority 2 - Those actions necessary to maintain the species' current population status.

Priority 3 - All other actions necessary to provide for full recovery of the species,

Abbreviations Used

AGFD	= Arizona Game and Fish Department
SE	= U.S. Fish and Wildlife Service, Endangered Species Program
USFS	= U.S. Forest Service
FR	= U.S. Fish and Wildlife Service, Fisheries Resources Program
USGS	= U.S. Geological Survey
HR	= U.S. Fish and Wildlife Service, Habitat Resources Program
CES	= Centro Ecológico de Sonora

PART III - IMPLEMENTATION SCHEDULE

Priority #	Task #	Plan Task	Task Duration	Responsible Agency EWS Region	Program	Other	Fiscal Year Costs (estimates) FY 1	FY 2	FY 3	COMMENTS
1	I.A.	Recognize critical habitat	Ongoing	2	SE	FS AGFD				
1	I.B.	Remove nonnative fishes a5 needed	Ongoing	2	SE	FS AGFD				5,000/removal (a5 needed)
3	I.C.	Determine water use pattern5 and protect water right5	2 year5	2	SE	FS AGFD	3,000	3,000		FS may have this information
2	I.D.	Incorporate Sonora chub management needs into management plan5 for Goodding RNA and Pajarita Wilderness	2 year5	2	SE	FS AGFD		1,000	1,000	
1	I.E.	Ensure habitat integrity	Ongoing	2	SE	FS AGFD	2,000	2,000	2,000	
2	I.F.	Survey all existing and potential habitat5	3 year5	2	SE	FS AGFD CES	5,000	5,000	5,000	
2	II.A.	Establish and maintain standardized monitoring technique5 for fish and habitat	3 year0	2	SE	FS AGFD CES	2,500	1,000	1,000	
3	II.B.l.	Determine reproductive variable5	4 years	2	SE	FS AGFD CES	8,000	8,000	8,000	
2	II.B.2.	Determine effect5 of predation and competition	4 years	2	SE	FS AGFD CES	8,000	8,000	8,000	
3	II.B.3.	Determine survivorship by age group	4 years	2	SE	FS AGFD CES	2,000	2,000	2,000	
3	II.B.4.	Determine disease and parasites	4 years	2	SE FR	FS AGFD CES	1,000	1,000	1,000	

PART III - IMPLEMENTATION SCHEDULE

Priority #	Task #	Plan Task	Task Duration	Responsible Agency FWS Region	Program	Other	Fiscal Year Costs (estimates) FY 1	FY 2	FY 3	COMMENTS
2	II.B.5.	Determine diel, seasonal, and annual distribution of life stages	3 year8	2	SE	FS AGFD CES	5,000	5,000	5,000	Could be combined with II.A or other habitat work
3	II.B.6.	Determine other factors pertinent to perpetuation of Sonora chub	Ongoing	2	SE	FS AGFD CES	2,000	2,000	2,000	
2	II.C.1.	Determine fish-habitat relationships	3 years	2	SE	FS AGFD CES	8,500	8,500	8,500	
2	II.C.2.	Determine precipitation-runoff relationships	LO years	2	SE	USGS FS CES	0,000	5,000	3,000	
3	II.C.3.	Evaluate relationships of runoff-in&ream flow neede	5 years	2	SE	AGFD CES FS	2,500	2,500	2,500	
2	III.A.	Establish captive reserve populations	Ongoing	2	FR	AGFD CES		LO, 000	LO, 000	
2	III.B.	Determine the genetic variability of the species	3 years	2	SE	FS AGFD CES	10,000	10,000	2,000	
2	IV.A.	Produce an information pamphlet	1 year	2	SE	FS AGFD CES	1,500			
2	IV.B.	Issue news releaeee	3 mo.	2	SE	FS AGFD CES	1,ooc			
2	IV.C.	Develop and conduct interpretive programs	Ongoing	2	SE	FS AGFD CES	5oc	1,500	500	Interpretive display at trailhead FY 2
2	IV.D.	Provide status informatior to interested parties	Ongoing	2	SE	FS AGFD	5oc	500	500	

PART IV - COMMENTS RECEIVED

A total of 11 letters of comment were received on the Sonora chub recovery plan. All letters of comment are reproduced and attached. Responses to comments were incorporated in two ways: 1) editorial comments, corrections of factual errors, etc., were incorporated directly into the text; or 2) comments concerning plan content were addressed in specific responses, although similar comments were grouped together and answered as one. Numbers and letters in the margin5 of the letters refer to the appropriate response or responses for that comment'.

1. Response to letter from Paul C. Marsh, Associate Professor, Arizona State Univ.

   A. Information on Arizona Game and Fish's objective to transplant Sonora chub from Sycamore Creek into several off-channel habitats has been incorporated into the document.

   B. The list of items classified as Priority 1, "... absolutely essential to prevent extinction...", has been reduced to include: recognizing critical habitat, removing nonnative fishes, and ensuring habitat integrity.

   In addition, editorial comments were written on the manuscript. The majority of the comments were useful and incorporated as suggested.

2. Response to letter from Larry Linser, Deputy Director, Arizona Department of Water Resources

   Information on filing for instream flow rights will be filed for further use.

3. Response to letter from Alejandro Varela-Romero, Area de Ecología Acuática, Centro Ecológico de Sonora

   No specific suggestions given.

4. Response to letter from Jerry Lockwood, District Ranger, Coronado National Forest

   The majority of the letter does not provide specific recommendations. We appreciate the general information.

   A. According to Larry Henson, Regional Forester, U.S. Forest Service, Southwestern Region, (letter dated September 9, 1992) the International boundary (which may or may not include a fence) is maintained by the International Boundary & Water Commission not the USDA Animal & Plant Health Inspection Service (APHIS).

5. Editorial comments were written directly on the manuscript (no cover letter submitted) by Dr. W.L. Minckley, Arizona State University, Department of Zoology. The majority of the comments were useful and incorporated as suggested.

6. Response to letter from Duane Sbroufe, Director, Arizona Game and Fish Department

   A. Page iv, Recovery Strategy
   This point is covered in the Recovery Objective: Protection.

   B. Page iv, Actions Needed
   The intent of this suggestion is covered in the Plan Task: Establish captive reserve populations.

C. Page 7, Distribution and Abundance
Incorporated as suggested.

D. Page a
The personal communication with Will Hayes has been deleted.

E. Page 11, paragraph 1
Paragraph modified to indicate that variation in size may be due to differer size class strength or a possible result of multiple spawning8 in a year.

F. Page 11, paragraph 3
This paragraph describes general habitat requirements, not preferred habitat

G. Page 12, Continuation paragraph and paragraph 1
After telephone conversations between Debra Bills, FWS, Phoenix, and Dean Hendrickson, Texas Memorial Xuseum at the University of Texas, Dr. Hendricks clarified that the species was not abundant in areas where velocity was higl The fish moved into low velocity, protected areas. However, electrofishing the area during high floods resulted in high catch rates of fish concentrate in those protected areas.

H. Page 12, last paragraph
Information added citing Dennis Kubly, AGFD, pers. comm.

I. Page 14
Incorporated as suggested.

J. Page 28
Although the suggestion is pertinent, this is not the appropriate place in t document. The threats on this species are clearly defined in the introduction. The chub is ". ..particularly vulnerable to . . . threats becau of its very limited range in the United States. and because of the intermittent nature of Sycamore Creek (USFWS 1986)."

K. Page 33
Incorporated as suggested.

L. Page 34
Clarify that AGFD and FWS will assist USFS, the lead agency.

M. Page 36
Clarify that practices that result in highly erosive floods that deliver la amounts of sediment should be curtailed.

In addition, editorial comments were written on the manuscript. The majority of t comments were useful and incorporated as suggested.

7. Response to letter from Larry Henson, Regional Forester, U.S. Forest Service

Document-wide comments:

The use of "intermittent" appears to be appropriate in the reference to Sycamore Creek.

A. Page 16
Incorporated as suggested.

B. Page 17
Incorporated as suggested.

C. Page 20 & 27

Information corrected in text.

D. Page 24
No action taken.

E. Page 26
No action taken.

F. Page'29
Incorporated as suggested.

G. Page 35
Incorporated as suggested.

H. Page 36
These two items could be conducted simultaneously under the existing document plan.

I. Page 41
The Literature Cited has been updated to include Carpenter and Maughan's 1992, Final Report to Arizona Game and Fish Department.

8. Response to letter from Jeanettte Carpenter, National Ecology Research Center, Fish and Wildlife Service (Dated September 18, 1992).

A. Page 7, second paragraph, fourth sentence
Statement corrected by deleted sentence .

B. Page 8, third paragraph, first sentence
The reference to longfin dace has been deleted.

C. Page 11, third paragraph, second sentence
Statement has been modified to "Sonora chub is more likely in the largest, deepest, most permanent pools."

D. Page 11, third paragraph, last two sentences
Incorporated as suggested.

E. Page 12, third paragraph, second and third sentence
Reference to the species holding steadfast to a site has been deleted.

F. Page 13, second paragraph
This document now supports the Hendrickson and Juarez-Romero (1990) reference.

G. Page 15, first paragraph, last two sentences
This information is speculative and was not included.

H. Page 16, second paragraph
Incorporated as suggested.

I. Page 20, first paragraph, second sentence
Incorporated as suggested.

J. Page 27, first paragraph
Incorporated as suggested.

K. Page 35, second paragraph
A statement was added to evaluate "the effect of sediment loading on Sonora chub habitat."

9. Response to letter from Response to letter from Jeanettte Carpenter, National Ecology Research Center, Fish and Wildlife Service (Dated September 16, 1992)

A. Page 5, first sentence
Incorporated as suggested.

B. Page 6, second paragraph, second sentence
Incorporated as suggested.

c. Page 7, second paragraph, second sentence
Incorporated as suggested.

D. Page 10, second sentence
Incorporated as suggested.

E. Page 10, second paragraph, sixth sentence
Incorporated as suggested

F. Page 11, third paragraph, last sentence
Incorporated as suggested.

G. Page 12, third paragraph, first sentence
Incorporated as suggested.

H. Page 13, first paragraph, second sentence
Incorporated as suggested.

I. Page 16, second paragraph, third sentence
Incorporated as suggested.

10. Response to letter from George G. Bell and Thomas G. Bell, Jr., DVM, PhD, ZZ Catt Corporation

A. We believe the protection measures discussed are appropriate.

B. Although the objective of this document is "Protection" of the species, the document is still called a "Recovery Plan."

11. Response to letter from Dr. Exequiel Ezcurra, General Director, Instituto Naciona de Ecologica

A. Page 1, Paragraph 1
This document only discusses the recovery of the Sonora chub.

B. Page 1, Paragraph 6
The budget included in the document is an estimate and does not reflect divided cost between the State of 'Arizona and State of Sonora.

1.

A R I Z O N A S T A T E U N I V E R S I T Y
Center for Environmental Studies
Tempe, Arizona 85287-3211
(602) 965-2977/2975
FAX (602) 965-8087/0213

22 July 1992

Mr. Sam F. Spiller, Field Supervisor
U.S. Fish and Wildlife Service
3616 West Thomas Road, Suite 6
Phoenix, Arizona 85019

Dear Mr. Spiller:

As requested, I have reviewed the draft "Sonora chub, *Gila ditaeniq*, recovery plan" and offer the following comments. At the outset, hr. Stefferud and the Desert Fishes Recovery Team are to be commended for their efforts -- the plan is lucid, well organized, and provides background and guidance to direct management and conservation of the species. If designated tasks are successfully fulfilled and the objectives of the plan can be attained, Sonora chub should be "secure" in the United States within the identified timeframe.

A few comments, mostly editorial in nature, have been made directly on the enclosed copy of the draft -- these are provided for your consideration. My major concerns follow:

A. (1) Arizona Game and Fish Department (AZGFD) is currently moving toward transplantation of Sonora chub from the Sycamore Creekmainstream to several off-channel habitats. Presumably, this activity is being coordinated and conducted in cooperation with U.S. Fish and Wildlife Service and U.S. Forest Service; Hr. Stefferud and your office should thus have particular insight into this "project." I see no mention in the plan of this important activity -- either an inadvertent oversight or an intentional omission. Regardless, these proposed transplantations are significant and should be addressed.

B. (2) Part III (Implementation schedule) of the plan designates 9 of 22 tasks as priority 1 ("...absolutely essential to present extinction..."). I do not agree with this prioritization for two reasons: (1) only task I.E (ensure habitat integrity) is realistically a top priority, and (2) in the "big picture" of threatened and endangered species of the region, assignment of excessive priority 1 tasks for Sonora chub actually or potentially dilutes efforts in behalf of other taxa that are clearly in greater peril of extermination. I thus recommend that all priority 1 tasks (except I.E) be designated priority 2, and that all priority 2 tasks be designated priority 3. I am not naive to the implications for potential Sonora chub funding such reassignment of task priorities might have, but strongly believe that such a compromise would benefit other species but not further imperil the chub.

Thank you for this opportunity to provide input. Please contact me if you have any questions or require further discussion.

Sincerely,

Paul C. Marsh
Associate Professor, Research

encl.

JUL 24 1992

2

ARIZONA DEPARTMENT OF WATER RESOURCES
15 South 15th Avenue. Phoenix. Arizona 65007
Telephone (602) 542-l 553
Fax (602) 256-0506

July 16, 1992

FIFE SYMINGTO
Governor

ELIZABETH ANN F
Director

Sam F. Spiller, Field Supervisor
U.S. Department of the Interior
Fish & Wildlife Service
Ecological Services
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

Dear Mr Spiller:

Thank you for your letter of July 8, 1992 and for the opportunity to comment on the Draft Recovery Plan for the Sonora Chub. The plan appears to be a reasonable and thorough approach to protect the species.

On page-24 Section C, you address the issue of evaluating existing water rights and the possibility of filing for instream flow rights for Sycamore Creek. When you decide to begin these processes, we recommend that you contact Joe Stewart of our office, who can be contacted at 602-542-1581. He can furnish you with a list of the existing water right filings for the Sycamore Creek watershed within Arizona. He can also assist you in filing for the instream flow rights for Sycamore Creek. For your use, we have enclosed a copy of our "Guide to Filing Applications for Instream Flow Water Rights in Arizona".

For your information, Mexico is presently diverting water from the Rio Magdelena for use in Nogales Sonora. These diversions will probably increase with the expanding growth of Nogales Sonora and their corresponding increasing demand for water. Much of this flow is diverted to the U.S. as sewage which is treated at the international treatment plant located on the Santa Cruz River near Nogales, Arizona. The treated effluent is released into the Santa Cruz River and becomes the water source for a significant reach of riparian vegetation located downstream from the treatment plant.

We appreciate the offer to comment on the stated draft document and look forward to working with you on the identified water right issues.

Sincerely,

Larry Linser
Deputy Director

LL/meh
Enclosures

JUL 17 1992

Hermosillo, Sonora. Agost 31. 1992.

Sam F. Spiller
US Fish and Wildlife Service
Ecological Services
3616 W. Thomas. Suite 6
Phoenix, Arizona 65019

Dear Sam Spiller:

I have reviewed "The Sonora Chub. *Gila ditaenia* Recovery Plan" and find it in good shape. J. A. Stteferud. Debra Bills and Ren Lohoefener did an excelent job.

Thank you for the opportunity to review and comment this Rcovery Plan.

Sincereiy

Alejandro Varela-Romero
Area de Ecolocia Acudtica
Centro Ecológico de Sonora

SEP 8 1992
RECEIVED
U.S. FISH & WILDLIFE SERVICE

C.c.p. J. A. Stteferud, Tonto National Forest.
Phoenix Az.

KM 2 CARRETERA A GUAYMAS APARTADO POSTAL No 1497 TEL. (63) 13-35-37 Y 13-23-56 FAX (63) 13-23-58 HERMOSILLO, SON.
centro ecológico de Son.

4.

United States Department of Agriculture | Forest Service | Coronado National Forest | Nogales Ranger District | 2251 North Grand Avenu
Nogales, AZ 85621
(602) 281-2296
FAX (602) 670-5075

Reply To: 2670

Date: 7/27/92

USDI Fish and Wildlife Service
Ecological Services
3616 W. Thomas, Suite 6
Phoenix, AZ 85019

Dear Mr. Spiller:

Thank you for the opportunity to comment on the Sonora Chub Draft Recovery Plan. We appreciate your efforts to bring together all this information o behalf of the Chub. Your document was quite thorough and we would like to offer the following comments:

I. WATERSHED CONDITION

A. Numerous inferences are made that the watershed is in a degraded condition, but no reference is made to the condition from which watershed has degraded.

B. An on the ground examination reveals geologically young soils th are easily eroded during the short duration, high intensity, sum thunderstoms that cause a significant amount of overland flow.

C. In addition the shallow, rocky soils have a very low productivit to produce enough biomass to stabilize the watershed. These soi also rate very low for revegetation potential. Man caused perturbations may be a small contributing factor to the sediment moving down Sycamore Canyon but basically it is a developing, dynamic ecosystem that will continue to scour and fill the pool: for many years.

II. RANGE CONDITION

A. The plant community is composed of a wide variety of native grasses. Both warm and cool season species are present which w indicate a fair range condition.

B. There are some concentration areas near riparian areas and ridg tops where the composition is not what it should be but as a wh the watershed has a good diversity. Except for these few areas plant density is adequate for fair range condition and may be a' that these soils are capable of producing.

AUG 13 1992

C. The vigor of plants on this site varies dramatically with rainfall. In most years, much bare soil is evident during dry period in May and June. A dramatic recovery occurs as soon as the summer rains come. Expressions of concern by the public are made each spring about overgrazing but in a normal rainfall year the range has a lush appearance by late July.

The current grazing plan for the Bear Valley Allotment is being revised to address the issue of low plant vigor. It is felt that with the rest-rotation grazing, plants will be allowed to increase in crown size, thus, providing better protection from raindrop impacts and provide more litter on the watershed.

Excessive utilization of ridgetops and areas close to water will be addressed through improved distribution of cattle and a more rapid rotation through the pastures.

Given the factors of soils and climate, it is unrealistic to assume any changes in management will bring about dramatic changes in watershed conditions.

III. HISTORY OF LAND USES

Livestock

Livestock were first introduced to the area during the mission area (about 1500) but significant use of these remote mountain watershed probably did not occur until the end of the Civil War. A period of severe overgrazing ensued from that time until after the creation of the National Forest. At the time that the Forest Service assumed management responsibility, 5000 - 10,000 head of cattle grazed the Atascosa Mountains with little or no control. The Bear Valley Allotment permit called for 650 head of cattle in 1917. These numbers were reduced to 520 head in 1930. Stocking remained at 500 through 1965. In 1978 the numbers were reduced to the presently permitted 350. Recent efforts have been to improve the range conditions through improved management rather than continued reduction in tine number of cattle permitted.

Mining

During this same time period, mining has been permitted in the watershed but limited to _____ (**check for specifics) little activity has occured.

Recreation

The popularity of Sycamore Canyon for dispersed recreation has greatly increased in recent years. Popular activities include hiking, nature study, deer and quail hunting, softball/volleyball, and some overnight camping in the area around Hank & Yank Spring. Historically, recreation uses have not proven detrimental to the watershed but it is becoming apparent that more regulation of sports activities is needed to protect the riparian area. Recreation emphasis is shifting away from nature study activities towards a more general type of use. The level of recreation use is approaching a level that will require closer regulation of activities to protect riparian vegetation and water quality.

Roads

Primitive roads have grown up throughout the watershed and many of th are producing sediment, which is transported through the stream chann with each run-off event. With exception of the Ruby road, no maintenance is currently funded.

The Draft Recovery Plan contains numerous inferences to less than satisfactory watershed management practices and a "degraded condition". I calls for a plan to improve watershed conditions. We feel that the Standa and Guidelines of the Coronado Land Management Plan adequately guides this effort. The Bear Valley Allotment Management Plan is currently being revi under these Standards and Guidelines.

The Plan also addresses the maintenance of the international boundary fenc This responsibility is assigned to USDA Animal & Plant Health Inspection Service (APHIS) and not the International Boundary & Water Commission. AP has the mission of protecting the US livestock industry from imported disease(s). Maintaining a fence in such a remote location has proven very difficult. The grazing permittee on the Bear Valley Allotment has little
4 incentive to maintain the portion of the fence in Sycamore Canyon because cattle do not graze there. While we would agree, in principle, that the Forest Service is better suited to maintain the fence, present and anticipated budget levels would preclude our assuming responsibilities of another agency.

Thanks again for the opportunity to comment on the Plan and we look forwar to continuing to work with you towards the recovery of this important species. Please feel free to contact me if we can be of further assistanc in this matter.

Sincerely,

Jerry Lockwood

JERRY L. LOCKWOOD
District Ranger

5.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

July 8, 1992

Comments etc on Manuscript

MEMORANDUM

TO: Interested Parties

FROM: Field Supervisor

SUBJECT: Draft Recovery Plan for Sonora chub

The Fish and Wildlife Service has completed the draft recovery plan for the threatened Sonora chub (Gila ditaenia). We are now seeking comment on the draft document from agencies and the public.

A copy of the draft recovery pian has been included with this announcement. We would appreciate receiving anv comments you may have within 60 days of receipt of this announcement.

If you have any questions, please contact Debra Bills or Ren Lohoefener (Telephone: 602/379-4720).

for Sam F. Spiller

Enclosure

Distribution

RECEIVED
SEP - 2 1992
U.S. FISH & WILDLIFE SERVICE
ES FIELD OFFICE - PHOENIX, AZ

6.

THE STATE OF ARIZONA

GAME & FISH DEPARTMENT

2221 West Greenway Road. Phoenix. Arizona 850234399 (602) 942-3000

G
Fife Syr
Commis
Gordon K. Whiting. Central. Ch
Larry Taylo
Elizabeth T. Woodin.
Arthur Porter.
Nonie Johnson. Sn
Duane L.
Deputy
Thomas W. :

September 1, 1992

Sam Spiller, Field Supervisor
Fish and Wildlife Service
Ecological Services
3616 W. Thomas, Suite 6
Phoenix, AZ 85019

Dear Sam:

Please find enclosed review comments on *the* "Sonora chub, *Gila ditaenia*, recovery plan." The document is well written and covers all aspects important to the protection of this threatened fish. The majority of our comments are editorial in nature, and we have simply noted them in the margins. Those comments which are more than editorial in nature are contained in an attachment to this letter. Thank you for the opportunity to comment on the recovery plan. If you or your staff have any questions on the comments, please contact Dennis Kubly by phone at 789-3516.

Sincerely,

Duane L. Shroufe
Director

DLS:DMK:dk

Attachment

cc: Dennis Kubly, Nongame
Will Hayes, Region 5

RECEIVED
SEP - 9 1992
U.S. FISH & WILDLIFE SERVICE
ES FIELD OFFICE - PHOENIX, AZ

ARIZONA GAME AND FISH DEPARTMENT
SONORA CHUB RECOVERY PLAN REVIEW

A. 1. **Page iv, Recovery Strategy:** Add to the last sentence the following: ". ..and to secure populations in protected areas."

B. 2. **Page iv, Actions Needed:** A fifth action should be added with this suggested wording: "Investigate and, where appropriate, implement transplants into suitable sites within the historical range for Sonora chub."

C. 3. **Page 7, Distribution and** Abundance: Surveys by Department personnel in May 1992 produced collections of Sonora chub to within one km of the border with Mexico. **Atascosa** *Canyon* should be added to the list of locations inhabited by the chub.

D. 4. **Page 8, Continuation sentence to p.** 9: The reference to personal communication with Will Hayes, AGFD, is incorrect. Stock tanks in the Sycamore watershed were surveyed during the fall of 1982, but no fish were observed or collected. The survey method was tested in a stock tank outside of the Sycamore watershed near Pena Blanca Lake. Goldfish and **green** sunfish were collected, thus proving the effectiveness of the sampling method.

E. 5. **Page 11, Paragraph 1: It** seems that variation among populations in length frequency distributions could be due to differences in year-class strength or differences in the number of spawning events.

F. 6. **Page 11, Paragraph** 3: It is not clear which combination of habitat features is favored by Sonora chub.

G. 7. **Page 12, Continuation paragraph and paragraph 1:** Two sentences here are contradictory. Fist, it is stated that "The species was noticeably less abundant where current velocity was high...". In the subsequent sentence, it is stated that "Catch...per unit of effort was high in *sites* where flow and velocities were high,..."

H. 8. **Page 12, last paragraph:** AGFD surveys suggest chub do move to occupy new habitats, **not all** of which are perennial.

I. 9. **Page 14, paragraph 2:** We believe that the Sycamore drainage has experienced significant change since the late 1880's with the introduction of domestic livestock, mining, stock tank construction, and spring modification. Describing this watershed as unmodified does **not** accurately represent the changes from *historic* to current conditions.

J. 10. **Page 28, Paragraph** 2: We are in agreement that all efforts at reestablishing Sonora chub should follow appropriate guidelines. It would be beneficial to add a sentence to this paragraph acknowledging that the restricted distribution of Sonora chub in the United States increases the danger that a catastrophic event might extirpate the species.

Reestablishment into other locations provides greater assurance that the consequences **of** such an event will not include extirpation.

K. 10. **Page 33, Number 6:** Add diet and interactions with other species in the stream community to the list of other factors pertinent to perpetuation of the chub.

L. 11. **Page 34, paragraph 2:** Field studies can be accomplished more expeditiously and efficiently if agency personnel work together to accomplish these tasks, rather than some agencies just serving in an advisory capacity.

M. 12. Page 36, Number 3: Earlier in the document (pp. 6-7) there is language to suggest that seasonal flash-flooding probably keeps nonnative fishes from becoming established in canyon-bound streams. Perhaps, the emphasis here should be on watershed practices which lead to highly erosive floods that deliver large amounts of sediment to the streamcourse. Stability of the hydrograph, depending on the interpretation, may not be desirable.

United States Department of Agriculture
Forest Service
Southwestern Region
517 Gold Avenue SW.
Albuquerque, NM 87102-0084
FAX: (505) 842-3800

7.

Reply To: 2670

Date: SEP 09 1992

Mr. Sam F. Spiller
Ecological Services
U.S. Fish and Wildlife Service
3616 W. Thomas, Suite 6
Phoenix, AZ 85019

Dear Mr. Spiller:

The Forest Service offers the following comments on the draft recovery plan for the Sonoran chub (Gila ditaenia):

Document-wide comments:

Throughout the document, Sycamore Creek is referred to as an "intermittent" stream. Intermittent means there are periods of time when a stream ceases to flow, although it may flow for long periods of time after a rain event. The terms intermittent, ephemeral and perennial refer the flow regime as it relates to time, and intermittent streams do not support fish because at some time during the year there is no water. Our interpretation of the terminology is that in addition to variations in time, we also need to describe variations in space, using the terms "continuous" or "interrupted". As a result, we propose that Sycamore Creek is properly described as "perennial interrupted", as it is in the Region 3 Riparian Area Survey (July, 1989).

The Coronado National Forest Land and Resource Management Plan (LRMP) contains considerable information relevant to management of the area and management for the species. There is strong management area direction for management of the area for wildlife values, there are standards and guidelines directing cooperative work with the Arizona Game and Fish Department and the U.S. Fish and Wildlife Service on threatened and endangered species, and the plan lists this species as a management indicator end provides a minimum desired habitat goal for the species.

Page 16 (Last paragraph):

A.

Third sentence: Add that California Gulch is the next major drainage, approximately 3 miles west of Sycamore Canyon.

Page 17 (Paragraph 21):

B.

Add that bullfrogs have not been reported from Sycamore Creek, but do exist in adjacent watersheds.

SEP 14 1992

Paae 20 & 27:

C. It is the responsibility of the International Boundary and Water Commission to identify and maintain the international boundary which may or may not include the use of fencing. It is the responsibility of the USDA Animal & Plant Health Inspection Service (APHIS) to prevent Mexican livestock from crossing into the United States, but they do not currently maintain the fence. The Forest Service can expend monies to maintain the fence which is generally set inside of the actual border but given current funding and staffing levels, this may not always occur. In addition this fence occurs in remote, rugged country and involves a complex "water gap" that in the practical sense makes the fence very difficult and costly to maintain. Border fences in this area are also subject to being cut by illegals using livestock to haul goods across the border.

Page 24 (Last paragraph):

D. The recommendation here is that water rights affecting Sonoran chub should be "purchased, withdrawn or otherwise acquired'. If those uses are found to be a threat in their own right, this option should be considered. However, this action would tend to alienate the water user(s) involved, and could be destructive to future cooperative relations. Instead, the USFS should investigate the need for acquiring an instream flow right. If such a right is deemed necessary, application should be made for flows based on habitat needs or median flow, whichever is most likely to be approved for permit by the Arizona Department of Water Resources.

Page 26 (After second paragraph):

E. Critical habitat is affected by watershed condition. Desired future condition for this watershed is to have adequate ground cover to protect soil from the erosive actions of water and to promote maximum infiltration of water into the soil. The combination of effects of adequate ground cover are as follows: Sediment loads that permit pools and riffles to maintain consistent size and shape over time; sustained base flows (flows which continue after precipitation and surface runoff has ceased); and flood-stage flows that occur at intervals necessary for riparian plant community development. The following table summarizes ground cover conditions that are adequate and optimum for the ecosystems occurring within the Sycamore Canyon watershed.

Ecosystem	Ground Cover (not including rock) Tolerable Level (%)	Optimum Level (%)
Broadleaf Woodland l-354 slope	20	34
Broadleaf Woodland 25-45% slope	25	32
Broadleaf Woodland 40-60% slope	22	25
Coniferous Woodland 40-60% slope	27	30

The Forest currently plans to undertake a watershed level Integrated Resource Management (IRM) approach to providing further planning and management for this watershed in fiscal year 1994.

Page :

F. Add Arizona Department of Environmental Quality to the list of agencies cooperating in monitoring. (The USFS has requested ADSQ to initiate quarterly monitoring of water quality in Sycamore Creek. On their own, they have begun a baseline data gathering project of macroinvertebrates. The results of that initial sample are expected in winter of 1993.)

Page 35 (Item 2) and Implementation Schedule:

G. Five years would give us an answer, but ten years is most desirable for getting a statistically valid relationship.

Page 36 (Item 3):

H. The evaluation of relationships of runoff-instream flow need might possibly be accomplished as part of Item 2 on page 35.

Page 41:

I. The document references and utilizes an annual report by Jesnette Carpenter. Her thesis has been complete and it may serve as a better source of information and reference than the annual report.

If there are questions regarding these comments to the Plan, please contact Bob LeFevre, Hydrologist, at the Coronado National Forest Supervisor's Office (602-670-6483) or Mary Gilbert, District Biologist, Noqales Ranger District, (602-281-2296).

Thank you for the opportunity to comment on the Sonoran Chub Draft Recovery Plan.

Sincerely,

for LARRY HENSON
Regional Forester

cc:
Nogales RD
USFWS-Albuquerque
Jerry Stefferud, Tonto NF
Randall Smith, Corona& NF

FAX FORM

U.S. FISH AND WILDLIFE SERVICE
NATIONAL ECOLOGY RESEARCH CENTER
4512 McMURRY AVENUE, FORT COLLINS, CO 80525-3400

FAX 303-226-9230
VERIFY 303-226-9398

8.

FOR: Debra Bills

DATE: 9/18/92 TIME SENT: 1:52 PM

FROM: Jeanette Carpenter

SUBJECT: Sonora chub draft Recovery Plan

Number of pages including cover sheet 7

RECEIVED
SEP 18 1992
U.S. FISH & WILDLIFE SERVICE
ES FIELD OFFICE - PHOENIX, AZ

8.

United States Department of the Interior
FISH AND WILDLIFE SERVICE
NATIONAL ECOLOGY RESEARCH CENTER
4512 McMurry Avenue
Fort Collins, Colorado 80525-3400

TAKE PRIDE IN AMERICA

In Reply Refer To:
FWS/Regi on 8/NERC

September 18, 1992

HMP: 119

Debra Bills
U. S. Fish and Wildlife Service
Ecological Services
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

Dear Debra,

The fallowing pages are my comments on the Sonora chub recovery plan, and they include the concerns I discussed with you on the phone September 16.

If I can be of any further assistnce, please do not hesitate to call;

Sincerely,

Jeanette Carpenter

Jeanette Carpenter'

Attachments

COMMENTS ON DRAFT OF SONORA CHUB RECOVERY PLAN
Jeanette Carpenter
September 18, 1992

A. Page 7, second paragraph, fourth sentence. I am not comfortable with this sentence, which is not in Carpenter and Maughan (1991). I consistently found *Sonora* chub in ephemeral pools, and many permanent pools occurred in low points of the thalweg or in bedrock depressions, not just near channel obstructions and scour points. Also, there is more than one spring source in Sycamore Canyon.

B. Page 8, third paragraph, first sentence. Extensive literature searches and review of collection records fail to verify that *Agosia chrysogaster* ever occurred in Sycamore Creek. Silvey et al. (1984), which is a literature and collections database, provides eight references for including both *Gila ditaenia* and *A. chrysogaster* in Sycamore Canyon of the Rio Magdalena drainage. They include the ichthyological collections of the University of Michigan and Arizona State University, and the following publicationsi Anonymous 1939, Lowe 1967, Miller 1949. Miller 1945, Minckley 1973, and Rinne and Minckley 1970. I have not seen Anonymous 1979, but I have thoroughly read the other five publications. They provide no information about A. *chrysogaster* over being found in Sycamore Creek. Silvey et al. (1984) and several unpublished papers cite Minckley (1973) for the source of information on A. *chrysogaster* in Sycamore Creek. However, Minckley (1973) makes no reference to *A. chrysogaster* in Sycamore Creek. I contacted the University of Michigan Museum and obtained reports of all their collections of this species, and it was not collected from Sycamore Creek.

I was not able to obtain a copy of the register of the Arizona State University ichthyological collections; however, W.L. Minckley and Dean Hendrickson are both very familiar with this collection. D. Hendrickson believes the report of A. *chrysogaster* in Sycamore Creek is an error (University of Texas, pers. comm., 1992). Minckley (1985) states that "longfin dace has not been recorded from the United *States* portion of Rio Concepcion, although it occurs in that drainage in Mexico" (page 29), and "Sonoran chub is the only indigenous fish species recorded from this system in the United States" (page 101). Therefore, I see no evidence that A. *chrysogaster* was in Sycamore Creek, and suggest that the phrase ", although longfin dace (*Agosia chrysogaster*), was once reported (Silvey et al., 1984)" be deleted. You could cite Minckley (1985) for the revised sentence, "Sonora chub is the only native fish in Sycamore Creek".

C. Page 11, third paragraph, second sentence. This sentence cites Minckley (1985); however, this sentence, which is on page 32 of Minckley (1985), is a citation from Minckley and Deacon (1968) and Minckley (1973). As I stated in my earlier review of the recovery plan, I disagree that "Sonora chub is found consistently in the largest, deepest, most permanent pools". To reiterate my previous concern, I have included the comments made earlier:

> Minckley 1973 and the BSIS printout cite Minckley and Deacon (1968) as evidence that Sonora chub is "apparently elusive", or that they are not found in 'perfectly good' habitats. The following is exactly what Minckley and Deacon stated in 1968, p. 1431, in *Science* magazine:
>
> "Data obtained in winter, when a given species retires to deep pools, may "document" its extinction, but in June the fish may swarm in shallow, more accessible places. We know that students who worked more than half a mile of stream in southern Arizona with electrofishing

equipment in an attempt to catch the Yaqui[1] chub, *Gila ditaenia*; they failed. The area they sampled was less than a fourth of a mile upstream from the canyon in which the species was abundant, and in which it remains abundant today; the stream was flowing in the area of sampling only as a result of persistent rainfall. Suoh errors are to be expected in any field operation, especially if specifio data are not generally available."

The point of this passage is that surveys performed during times of high water levels or when "specific data are not generally available" cause field operation errors. It says nothing about the behavior, habitat use, or distribution of Sonora chub. To refer to Minckley and Dsacon as saying that 'This behavioral trait has caused some collectors to report the species extirpated form Sycamore Crook.." because three students couldn't find them in a section of stream bed that is nearly always dry seems counter to the essential point of this quote.

The "specific data" Minckley and Deacon refer to is not clear: however, as I surveyed Sycamore Creek, I realized that there are several ways field biologists could mistakenly assume that Sonora chub should occur in a given area. For instance, errors can be made by 1) not knowing what parts of an intermittent stream are usually ephemeral or arc almost always disconnected from the main stream, 2) not realizing that "perfectly good' habitats are actually pools that recently dried up, killing provious populations, and then were re-filled after rainfall, or 3) not realizing that what appears to be "perfectly good' habitat may not even be available (i.e., connected) to the rest of the population at tho time of the survey.

The apparent 'elusiveness' of Sonora chub may bo an artifact of sampling bins. Therefore, I suggest that the sections in the draft that quote Minckley and Deacon in reference to Sonora ohub being elusive or extirpated should be dclctcd or re-phrased.

I realize that the "clusivc" part has been dclctcd from the Recovery Plan, but to say that Sonora chub are "found consistently in the largest, deepest, most permanent pools" seems to bo a re-wording of this "elusive" view. I did find that the deepest pools that decreased in depth the least over the summer provided the best habitat for survival of adult Sonora, cl Sonora chub were not esciusively in the deepest pools; 19% of the surface area occupied by adults in May 1991 had dried by July of that year. This percentage was even higher for younger fish: about 70% of the surface area occupied by only subadults and juveniles were ephemeral areas. Mauy shallow areas that

[1] Tho authors apparently used an incorrect common name for *Gila ditaenia*

were fed by nearby springs were also occupied. In addition, winter reconnaissance surveys did not indicate that Sonora chub "retired" to deep pools.

D. Page 11, third paragraph, last two sentences. See edits on attached page.

E. Page 12, third paragraph, second and third sentence. See comments for page 11.

F. Page 13, second paragraph. This paragraph contradicts the sentences on page 12 mentioned above, but supports what I believe to be true. Hendrickson and Juarez-Romero (1990) researched the spccict in Mexico, and indicotcd that it is adept at exploiting marginal habitats.

G. Page 15, first paragraph, last two sentences. It is possible that whatever agent extirpated the Tarahumara frog in Sycamore. Creek may at some Point impact Sonora chub populations.

H. Page 16, second paragraph. In 1990-1991, I also frequently saw cattle and evidence of grazing in the allotment directly upstream of Sonora chub critical habitat. There is little riparian vegetation in this allotment. I am not a range management biologist, but I am confident that the riparian zone of the main *channel* of Sycamore Creek above the RNA boundary has been impacted. Riparian degradation abovo the RNA will mom likely impact Sonora chub habitat throughout its U.S. range (since sediment and water move downstream) then degradation near the border, which is at tho extreme lower end of the species' U.S. range end contains few permanent pools. You could cite my thesis (pages 57-58) instead of personal communication.

I. Page 20, first paragraph, second sentence. The last part could bc changed to "and a study detailing macrohabitat and microhabitat characteristics of Sonora chub was completed (Carpenter 1992)".

J. Page 27, first paragraph. The management scheme for this allotment needs to bo examined and recommendations enforced.

K. Page 35, second paragraph. To effectively manage Sonora chub habitat in Sycamore Creek, it may help to dotcnninc tho effect of sediment loading on Sonom chub habitat.

Literature Cited

Anonymous. 1979. The status and management proposals for the threatened and endangered fishes of the Coronado National Forost. USDA Forest Service, Coronado National Forest, Tucson, Arizona. 16 pp.

Carpenter, J. 1992. Summer habitat use by Sonora chub in Sycamore Creek, Santa Cruz County, Arizona. M.S. Thesis, University of Arizona, Tucson. 83 'pp.

Carpenter, J. and E.O. Maughan. 1991. Habitat use of Sonora chub (*Gila ditaenia*). Annual report, Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona, Tucson. 16 pp.

Hendrickson, D.A., and L.R. Juárez-Romero. 1990. Fishes of the Rio de la Conccpcion basin, Sonora, Mexico, with emphasis on determination of status oi the Sonora chub, *Gila ditaenia*, a threatened species. Southwestem Naturalist 36(2).

Lowe, C.H. (editor). 1967. The vertebrates of Arizona. University of Arizona Press, Tucson, Arizona 270 pp.

Miller, L. 1949. Field notes on the minnow, *Gila ditaenia* in southern Arizona. Copcia 1949:148-150.

Miller, R.R. 1945. A new cyprinid fish from southern Arizona, and Sonora, Mexico, with the description of a new subgenus of *Gila* and a review of related species. Copeia 1945:104-110.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department. Phonix, Arizona.

Minckley, W.L. 1985. Native fishes and natural aquatic habitats in U.S. Fish and Wildlife Service Region II west of the continental divide. Report to the U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Department of Zoology, Ariwna State University, Tempe, Arizona

Minckley, W.L., and J.E. Deacon. 1968. Southwestern fishes and the enigma of "endangered species". Science 159:1424-1432.

Rinnc, J.N. and W.L. Minckley. 1970. Native Arizona fishes. Part III "chubs". Arizona Wildlife Views 17(5):12-19.

Silvey, W., J.N. Rinnc, and R. Sorenson. 1984. Index to the natural drainage systems of Arizona-a computer compatible digital identification of perennial lotic waters.

No data are available on preferred spawning sites, fecundity, larval survival and recruitment, growth, or dispersal. Length frequency distributions showed variation among populations in year-class strength, a possible result of multiple spawnings in a year (Hendrickson and Juárez-Romero, 1990).

The only information on food habits was based on examination of stomachs of a few individuals collected in early summer from Sycamore Creek. In decreasing order of volume, food consisted of aquatic and terrestrial insects, and algae. Like other chubs, Sonora chub is probably an opportunistic feeder that takes advantage of seasonally available resources (Minckley, 1973).

Habitat in Sycamore Creek is much more limited than in Sonora. in Sycamore Creek, Sonora chub is found consisrendy in the largest, deepest, most permanent pools (Minckley, 1985). ~~Preliminary~~ Analysis of habitat use by Sonora chub showed that the variables that discriminate between pools that support fish through the summer, and pools that do not, are maximum depth, the percent of decrease in maximum depth, Subst and the amount of floating cover. Interconnectedness of persistent vs. ephemeral habitats during high water levels may also be a factor affecting suitability of a macrohabitat (Carpenter ~~and Maughan~~, 1992).

In Mexico, the bulk of the collection by R. G. Miller was made in a one-meter deep pool formed by the roots of a fallen tree (Miller, 1945). In other samples, Sonora chub

9.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
NATIONAL ECOLOGY RESEARCH CESTER

4512 McMurry Avenue
Fort Collins, Colorado 80525-3400

TAKE PRIDE IN AMERICA

In Reply Refer To:
FWS/Region 8/NERC

September 16, 1992

HMP: 119

Debra Bills
U. S. Fish and Wildlife Service
Ecological Services
3616 W. Thomas, Suite 6
Fhoenix, Arizona 85019

Dear Debra,

Thank you again for allowing me to comment on the Sonora chub recovery plan.

As you requested, I re-read the plan and checked the citations you thought might be changed from the annual report Dr. Maughan and I wrote in 1991 to my thesis, which was completed this year. I also found that most of the personal communications attributed to me can now be referred to my thesis. The attached page describes these potential changes; it does not include the changes based on my general comments about the recovery plan, which will be sent separately.

Sincerely,

Jeanette Carpenter

Jeanette Carpenter

Attachment

SEP 21 1992

Potential changes in citations to Sonora chub recovery plan:

A. Page 5, first sentence: regarding area1 extent: Carpenter 1992.

B. Page 6, second paragraph, second sentence: regarding 150 mm specimens: pers. comm. (unpubl. data)

C. Page 7, second paragraph, second sentence: regarding distribution information: pers comm. (unpubl. data)

D. Page 10, second sentence: regarding Sonora chub as only species seen: Carpenter 1992 (page 64)

E. Page 10, second paragraph, sixth sentence: regarding timing of fry: Carpenter 1992 (page 62)

F. Page 11, third paragraph, last sentence: regarding interconnected habitats: Carpenter 1992 (page 47-48)

G. Page 12, third paragraph, first sentence: regarding abundance within habitat: Carpenter 1992 (pages 27-28)

H. Page 13, first paragraph, second sentence: regarding fish in ephemeral habitats: Carpenter 1992 (pages 26, 48)

I. Page 16, second paragraph, third sentence: regarding livestock in Sycamore Creek: Carpenter 1992 (pages 57-58)

Citations:

Carpenter, J. 1992. Summer habitat use by Sonora chub in Sycamore Creek, Santa Cruz County, Arizona. M.S. Thesis, University of Arizona, Tucson. 83 pp.

Carpenter, J. and E.O. Maughan. 1991. Habitat use of Sonora chub (*Gila ditaenia*). Annual report, Arizona Cooperative Fish and Wildlife Research Unit, University of Arizona, Tucson. 16 pp.

ZZ CATTLE CORPORATION
P.O. Box 1405
NOGALES, ARIZONA 85628-1405
602-761-3117

10.

George G. Bell
President

DR. Thomas G. Bell, Jr.
Vice President

August 30, 1992

TO: San F. Spiller
Field Supervisor
USDI, Fish & Wildlife

W. L. Minckley
Team Leader
Arizona State University

SUBJECT: Draft 'Recovery' Plan for Sonora Chub

A. While we are very sympathetic to the overall objectives of preserving the habitat of Gila ditaenia, particularly with respect to preventing accidental introduction of non-native fish which cay pray on this species ue are concerned, after studying the draft of the 'Recovery' plan, that some measures designed to protect existing habitat from degradation actually are of inappropriate design. The protection measures of the plan, as described, prescribe elaborate solutions to some minor threats while, based on our observation of the activities occurring within the habitat for 40 years, other important threats, such as the roads, are virtually ignored.

B. The ZZ Cattle Corporation and its predecessor partnership have been in operation since before the discovery of Gila ditaenia in Sycamore Canyon. When we contacted Professor Donald Garling, Michigan State University, and he conferred with Professor Miller at the University of Michigan, we became aware that the habitat distribution has probably not changed substantially since 1938. While ue can understand the designation of "threatened with critical habitat", we believe it is probably inaccurate and certainly misleading to title the Plan a "Recovc Plan; it could accurately be termed a plan to preserve, protect, maintai perpetuate, conserve or husband the Sonora Chub.

We would like to be kept informed and to participate in the ongoing planning process.

Sincerely,

George G. Bell
President and C.E.O.
ZZ Cattle Corporation

Thomas G. Bell, Jr.
Thomas G. Bell, Jr., DVM, PhD
Professor of Pathology
College of Veterinary Medicine
Michigan State University
and
Vice-President
ZZ Cattle Corporation

cc: Jerry Perry, Arizona State Game Commission
Jerry Lockwood, District Manager and Ranger, USFS
Jerome A. Stefferund, Team Hember and Author, USDA

FORMA C

INSTITUTO NACIONAL DE ECOLOGIA.
DIRECCION GENERAL DE APROVECHAMIENTO
ECOLOGICO DE LOS RECURSOS NATURALES.
RIO ELBA No. 20, 100. PISO.
COL. CUAUHTEMOC
06500 MEXICO. D.F.

SECRETARIA DE DESARROLLO
SOCIAL

OFICIO No. 0482

Ciudad de México. 25 AGO. 1992

SR. SAM F. SPILLER.
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGIAL SERVICES.
3616 W. THOMAS, SUITE 6
PHOENIX, ARIZONA 85019
U.S.A.

Me refiero al Plan de Recuperación del Pupo de Sonora Gila ditaenia, enviado a esta Direccidn General para su análisis y comentarios.

Al respecto le comunico que este documento es una excelente propuesta para el establecimiento de un plan de manejo para la recuperaci&n de Gila ditaenia en ambos países, sin embargo, ccnsiderando que en el lfmite de Estados Unidos y México, concretamente entre Sonora-Chi'nuahua y Arizona-Nuevo México, existen igualmente otras especies amenazadas o en peligro de extinción, seria importante la realización de un plan de manejo integral para todas las especies como son Ictalurus pricei, bagre del yaqui Gila ditaenia, C. macularius, P. occidentalis, G. intermedia y otras especies que existen en esta gran cuenca.

A

La creacidn de un plan integral permitiria incorporar a todos los investigadores que tradicionalmente han trabajado en toda el área, en un sólo objetivo común, como es el de recuperar y preservar a los peces del desierto, como sucede con algunas Instituciones y Dependencias Públicas y Privadas de los dos paises.

En la actualidad además de la recuperación de G. ditaenia también se trabaja en el proyecto denominado "Evaluación de las Poblaciones de C. macularius, P. occidentalis, I. pricei, G. ditaenia y G. intermedia en cueiicas compartidas del NW de México y SW de los Estados Unidos, a cargo del Centro Ecológico de Sonora y con apoyo económico del Arizona Game and Fish Department. Así como otros proyectos de investigacidn y colecta que se han llevado a cabo, con I. pricei y C. formosa a cargo del Dr. D. A. Hendrickson, del Texas Memorial Museum. Así como el proyecto "Diversidad de la Variabilidad Genética del Bagre del Yaquí", propuesto por el Dexter National Fish Hatchery de Nuevo Mexico.

En la mayoria de estos proyectos la colaboracidn del personal científico de Instituciones de ambos paises ha sido frecuente, debido a ello consideramos que sin demeritar el valor de esta propcesta, seria fructifero un plan integral con mayor alcance.

SECRETARIA DE DESARROLLO
SOCIAL

Particularmente sobre la propuesta enviada consideramos que el presupuesto calculado en cada actividad a desarrollar para la recuperacidn de G. ditaenia en la parte correspondiente al estado de Sonora, es limitado, debido a la gran extensión a cubrir, así como al niimero de cuerpos de agua que constituyen la cuenca baja, media y alta del Río Concepcibn, incluso, la parte baja de la cuenca será mas dificil recuperar, debido a la gran cantidad de actividades humanas que existen, así como al proceso acelerado de extracción de agua con fines agricolas.

Finalmente la cooperación entre distintas instituciones permitiria diseiiar el plan de manejo integral con objetivos nas amplios y a largo plazo entre ambos paises.

Por otro lado seria conveniente reformular el Punto IV "Producir Información para la Educación Piiblica en Mexico y Estados Unidos", a fin de lograr una mayor penetración y asimilación del programa al interior de la sociedad.

Sin otro particular, le reitero mi consideración mas distinguida.

SUFRAGIO EFECTIVO. NO REELECCION.
EL DIRECTOR GENERAL.

DR. EXEQUIEL EZCURRA.

C.c.p. C. Fis. Sergio Reyes Luján.-Presidente del Instituto Nacional de Ecología.-Pte
C. Lic. Santiago Oñate Laborde.-Procurador Federal de Proteccidn al Ambiente.-
C. Biól. Wilfrido Márquez Ramírez.-Director de Flora y Fauna Silvestres.-Pte
C. Biól. Eleazar Loa Loza.-Subdirector de Patrimonio.-Pte.
C. M. en C. Silvia E. Zárate V.-Jefa del Depto. de Flora y Fauna Acuáticas.-Pt
- Archivo General (11403).

/WMR/ELL/SEZV/amcs .

ASUNTO: PLAN DE RECUPERACION DEL PEZ Gila ditaenia.

EN RELACION AL PLAN DE RECUPEBACION DEL PUPO DE SONORA Gila ditaenia, ENVIADO A ESTA DIRECCION GENERAL POR EL SR. SAM F. SPILLER DEL *FWS* DE *ARIZONA,* PARA SU ANALISIS Y OPINION TECNICA; SE TIENEN LOS SIGUIENTES COMENTARIOS:

ESTE DOCUMENTO ES UNA EXCELENTE PROPUESTA PARA EL ESTABLECIMIENTO DE UN PLAN DE MANEJO PARA LA RECUPERACION DE G. ditaenia EN AMBOS PAISES; SIN EMBARGO ESTA PROPUESTA TAMBIEN DEBERIA CONTEMPLAR LA RECUPERACION DE OTROS ESPECIES QUE IGUALMENTE SE ENCUENTRAN EN RIESGO, COMO SUCSDE CON Ictalurus pricei, C. macularius, P. occidentalis Y G. intermedia ESPECIES CUYA DISTRIBUCION SE ENCUENTRA EN CUENCAS COMPARTIDAS ENTRE MEXICO Y E.U.A; ES DECIR ENTRE ARIZONA-NUEVO MEXICO Y SONORA-CHIHUAHUA; TODAS ESTAS ESPECIES SE ENCUENTRAN AMENAZADAS O EN PELIGRO DE EXTINCION DEBIDO A DIFERENTES ACTIVIDADES HUMANAS EN TODA EL AREA.UNA PROPUESTA INTEGRAL SERIA MAS PROVECHOSA PARA LA RECUPERACION DE VARIAS ESPECIES EN LUGAR DE UNA SOLA; MAXIME QUE LA DISTRIBUCION DE ESTAS ES CASI SIMILAR; Y EN MUCHOS ARROYOS Y CORBIENTES SE UBICAN EN SITIOS SEMEJANTES.

PARTICULARMENTE, ESTA PROPUESTA PARA RECUPERAR G. ditaenia ESTA ENCAMINADA A UNA PEQUEÑA PARTE DEL LIMITE DE ARIZONA Y SONORA; DEBIDO A QUE EN E.U.A. LA DISTRIBUCION DE ESTA ESPECIE ES MUY RESTRINGIDA DE MENOS DE 1000 KM2, APOYADA POR UNA GRAN CANTIDAD DE TRABAJOS CIENTIFICOS (27 APROXIMADAMENTE). MIENTRAS QUE EN MEXICO G. ditaenia SE DISTRIBUYEN EN UNOS 62,000 KM2, CORRESPONDIENTE A LOS RIOS, CONCEPCION, MAGDALENA, ALTAR, RIO, SECO, COYOTE Y COYOTITO; Y SOLO ES SUSTENTADA POR 3 TRABAJOS CIENTIFICOS. EN CONTRASTE CON E.U.A, DONDE EL ESTADO DE LAS POBLACIONES DEL PUPO ES MUY DEPLORABLE EN MEXICO LAS PCBLACIONES DE ESTA ESPECIE SE ENCUENTRAN TODAVIA POCO ALTEEAS JUNTO CON SUS HABITAT; SNCLUSO EL BANCO GENETICO DE LAS POBLACIONES NATURALES TODAVIA PRESENTA GRAN VARIABILIDAD.

SERIA CONVENIENTE EMPRENDER ACCIONES CONJUNTAS ENTRE INSTITUCIONES MEXICANAS Y NORTEAMERICANAS PARA DISEÑAR UN PLAN DE MANEJO PARA RECUPERAR TODAS LAS ESPECIES AMENAZADAS EN SONORA-CHIHUAHUA Y ARIZONA-NUEVO MEXICO.

SE ANEXA PROYECTO DE OFICIO A FIN DE PONERSE A CONSIDERACION DE LA DIRECCION GENERAL.

WMR/EKL/SLZV/amcs.