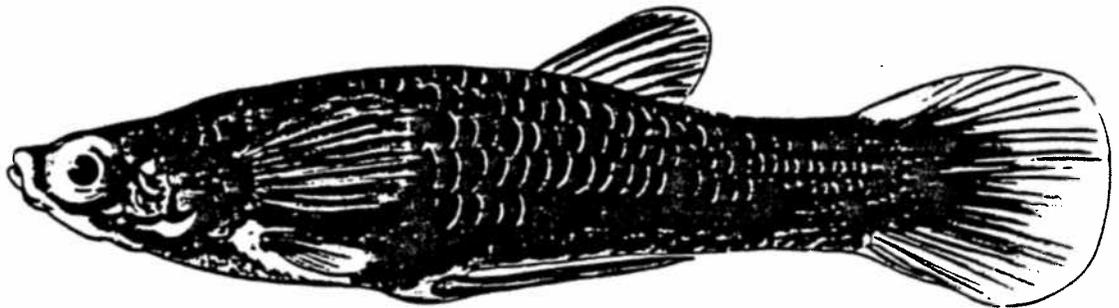


SONORAN TOPMINNOW

(GILA and YAQUI)

RECOVERY PLAN



1984

Albuquerque, New Mexico

RECOVERY PLAN

FOR

GILA AND YAQUI TOPMINNOW

(Poeciliopsis occidentalis Baird and Girard)

Prepared by

Sally E. Stefferud

April 20, 1982

for

U.S. Fish and Wildlife Service, Region 2
PO 20181-0286 - FY '82

Approved: _____

Joseph L. Stegman
Regional Director, Region 2 -

Acting U.S. Fish and Wildlife Service

Date: _____

March 15, 1984

PREFACE

This is the completed Gila and Yaqui Topminnow Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It does not necessarily represent official positions or approvals of cooperating agencies and it does not necessarily represent the views of all individuals who played key roles in preparing this plan. This plan is subject to modification as dictated by new findings and changes in species status and completion of tasks described in the plan. Goals and objectives will be attained and funds expended contingent upon appropriations, priorities and other budgetary constraints.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 1983. Gila and Yaqui Topminnow Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 56 pp.

Additional copies may be obtained from:

Fish and Wildlife Reference Service
1776 E. Jefferson Street
4th Floor
Rockville, Maryland 20852

SUMMARY

1. GOAL:

To remove the Gila and Yaqui topminnow from the Federal list of Endangered and Threatened species by restoring them as secure, stable, self-sustaining, and separate subspecies throughout a significant portion of their historic range.

2. RECOVERY CRITERIA:

Criteria for the downlisting of the Gila topminnow are based on the successful reintroduction of 20 new populations. Prior to 1987, delisting criteria are based on securement of at least 50 percent of the natural (or reclaimed) populations, plus the successful reintroduction of 50 new populations. If by 1987, attempts to secure protection for 50 percent of the natural populations have failed, then delisting will be initiated solely on the basis of the successful reintroduction of 50 new populations.

Because of the limited U.S. habitat, no intermediate downlisting to threatened is recommended for the Yaqui topminnow. Delisting should be initiated when all San Bernardino National Wildlife Refuge aquatic habitats have been restored, secured against exotic fishes, and reestablished with topminnow populations.

3. ACTION NEEDED:

Major steps needed to meet the recovery criteria include: monitoring and management of natural, reclaimed and reintroduced populations; surveying for undiscovered populations; removal of Gambusia affinis and other exotic fishes from topminnow habitats, and prevention of their reintroduction; reintroduction of topminnow within their historic range; acquisition of management rights or protective agreements for natural populations located on privately owned lands; and research into topminnow/mosquitofish, and topminnow/multiple-use-management relationships.

ACKNOWLEDGMENTS

Information and assistance in preparation of this draft plan was provided by James E. Johnson (U.S. Fish and Wildlife Service) John Rinne (U.S. Forest Service), W. L. Minckley (Arizona State University), Jim Brooks (Arizona Game and Fish Department), Ted Cordery (Bureau of Land Management), Bill Kepner (Bureau of Land Management), Charles Kennedy (U.S. Forest Service), Art Renfro (U.S. Forest Service), and Gary Meffe (Arizona State University).

A Technical draft was sent out for review on September 29, 1982, and commented upon by the following experts on Gila and/or Yaqui topminnows:

- R. R. Miller, University of Michigan
- J. N. Rinne, U.S. Forest Service
- J. E. Brooks, Arizona Game and Fish Department
- M. D. Hatch, New Mexico Department of Game and Fish
- G. K. Meffe, Arizona State University

An Agency draft was sent out for review on March 24, 1983, and comments were received from the following agencies:

- U.S. Forest Service, Region 3
- USDA Soil Conservation Service, Arizona State Office
- Arizona Game and Fish Department
- USDI Bureau of Land Management, New Mexico State Office
- USDI Bureau of Land Management, Arizona State Office
- USDI Bureau of Reclamation, Lower Colorado Regional Office
- New Mexico Department of Game and Fish
- U.S. Fish and Wildlife Service, Washington Office of Endangered Species

The Agency draft was sent out for re-review on August 30, 1983, and comments were received from the following agencies:

- U.S. Forest Service, Region 3
- Arizona Game and Fish Department
- USDI Bureau of Land Management, Arizona State Office
- USDI Bureau of Reclamation, Lower Colorado Regional Office
- New Mexico Department of Game and Fish

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GILA AND YAQUI TOPMINNOW RECOVERY PLAN

PART I - INTRODUCTION

Topminnows, of the genus Poeciliopsis, occur as natives in the United States as two subspecies, the Gila topminnow (Poeciliopsis occidentalis occidentalis), endemic to the Gila River system of Arizona, New Mexico, and northern Sonora, Mexico; and the Yaqui topminnow (P. occidentalis sonoriensis), a native of the Yaqui River system of southeastern Arizona and northern Mexico. Both topminnows were typically found in Sonoran Desert springs, streams, and marshes below about 4,500 feet. Both subspecies were listed as endangered by the U.S. Department of Interior in 1967 by publication in the "Federal Register" (FR 32:4001) of the binomial Poeciliopsis occidentalis. The State of Arizona lists both subspecies and New Mexico lists P. o. occidentalis, the only subspecies native to that State. The reasons for the endangered status of both subspecies are similar, habitat loss, and invasion of remaining habitats by the exotic mosquitofish (Gambusia affinis) and other predators such as the largemouth bass (Micropterus salmoides).

Since its listing, populations have continued to decline. This recovery plan outlines basic information on both subspecies of topminnow and the actions needed to halt their decline and to expand their numbers in both the existing habitat and in other suitable sites within their historic ranges. Implementation of this recovery plan will ensure the survival of the species and its genetic diversity, and consequently result in its downlisting or delisting.

Description and Taxonomy

The Gila and Yaqui topminnows are small live-bearers of the family Poeciliidae. Males seldom exceed 25 mm total length and females average 30 to 40 mm. They are tan to olive bodied and usually white on the belly. The scales of the dorsum are darkly outlined and the fin rays are outlined with melanophores, although lacking in dark spots. Breeding males are blackened, with some gold on the pre-dorsal midline, orange at the base of the gonopodium, and bright yellow pelvic, pectoral and caudal fins (Minckley 1973).

The two subspecies can be distinguished by several morphological characteristics. In P. o. occidentalis the snout is short, the mouth subsuperior and the dark lateral band of the female extends from the opercle to the base of the caudal fin. In P. o. sonoriensis the snout is longer, the mouth superior and the lateral band of the female rarely begins before the base of the pelvic fins (Minckley 1973).

The species was originally described in 1853 (Baird and Girard) from a specimen collected in 1851 from the Santa Cruz River near Tucson. It was named Heterandria occidentalis, but was redescribed in 1941 by Hubbs and Miller (1941) as P. occidentalis. The Yaqui form was described as a full species in 1859 (Girard). Both forms were recognized as separate subspecies by Minckley (1969b), who gave their distinguishing traits.

P. occidentalis is the only member of the family Poeciliidae that is native to the Gila River drainage and to the upper Yaqui River drainage in Arizona. Other members of the family, including mosquitofish (Gambusia affinis), guppies (Poecilia reticulata), sailfin mollies (P. latipinna), Mexican mollies (P. mexicana), green swordtail (Xiphophorus helleri), and variable platyfish (X. variatus) have been purposefully introduced into waters within these drainages as vector controls, or accidentally through the tropical fish trade.

Historic Distribution and Abundance

The topminnow is native to, and was originally distributed abundantly throughout, the Gila and Yaqui River systems in Arizona, New Mexico (Figs. 1 and 2), and northern Mexico; in the Sonoran Desert Life Zone (Lowe 1964).

Gila topminnow - The Gila topminnow was historically widespread and abundant in the Gila River drainage. Hubbs and Miller (1941) described it as "... one of the commonest fishes in the southern part of the Colorado River drainage basin, particularly in the Santa Cruz River system...." The Gila topminnow was once found in the Gila River mainstream from about 4,500 feet elevation downstream to the mouth of the river near Yuma, Arizona, and possibly even into the lower Colorado River itself (Minckley and Deacon 1968). It thrived in the Salt River as far upstream as the present site of Roosevelt Dam (Miller 1961) and high into the Verde River (Minckley 1973). There is one record of the Gila topminnow in New Mexico (Koster 1957) from the San Francisco River at Frisco Hot Springs. On the south side of the Gila drainage, Gila topminnow were also found in the Santa Cruz and San Pedro river systems. There are few records of Gila topminnow in the San Pedro system, but they were collected there in 1943 (Minckley, et al. 1977), and in 1978 in an unnamed artesian well outflow on the east side of the San Pedro River channel near Mammoth, Arizona (McNatt 1979). Records of topminnow from the Santa Cruz system are abundant and include the headwater area above Lochiel, Arizona (Minckley et al. 1977); that part of the river that flows through Sonora, Mexico, before returning to the United States (collections at Univ. of Michigan); the short formerly perennial mainstream flow near San Xavier Mission (Miller 1961); and various tributary streams and springs, most notably Sonoita Creek (Minckley et al. 1977). It is also likely that the Gila topminnow was once distributed throughout the San Simon River drainage to its source in San Simon Cienega on the Arizona-New Mexico border (Minckley et al. 1977). The Gila River subspecies is still extant in a few of the above localities.

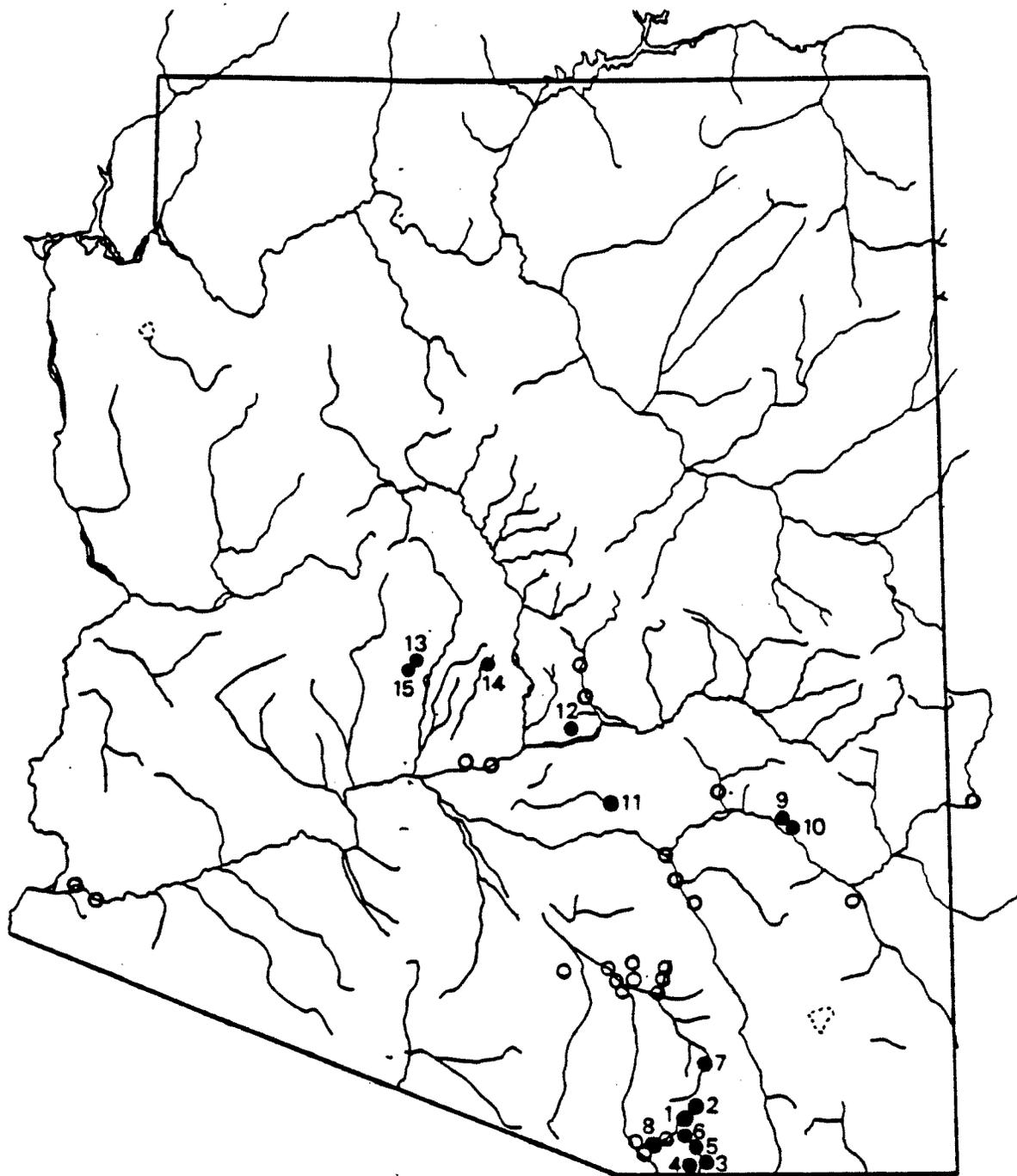
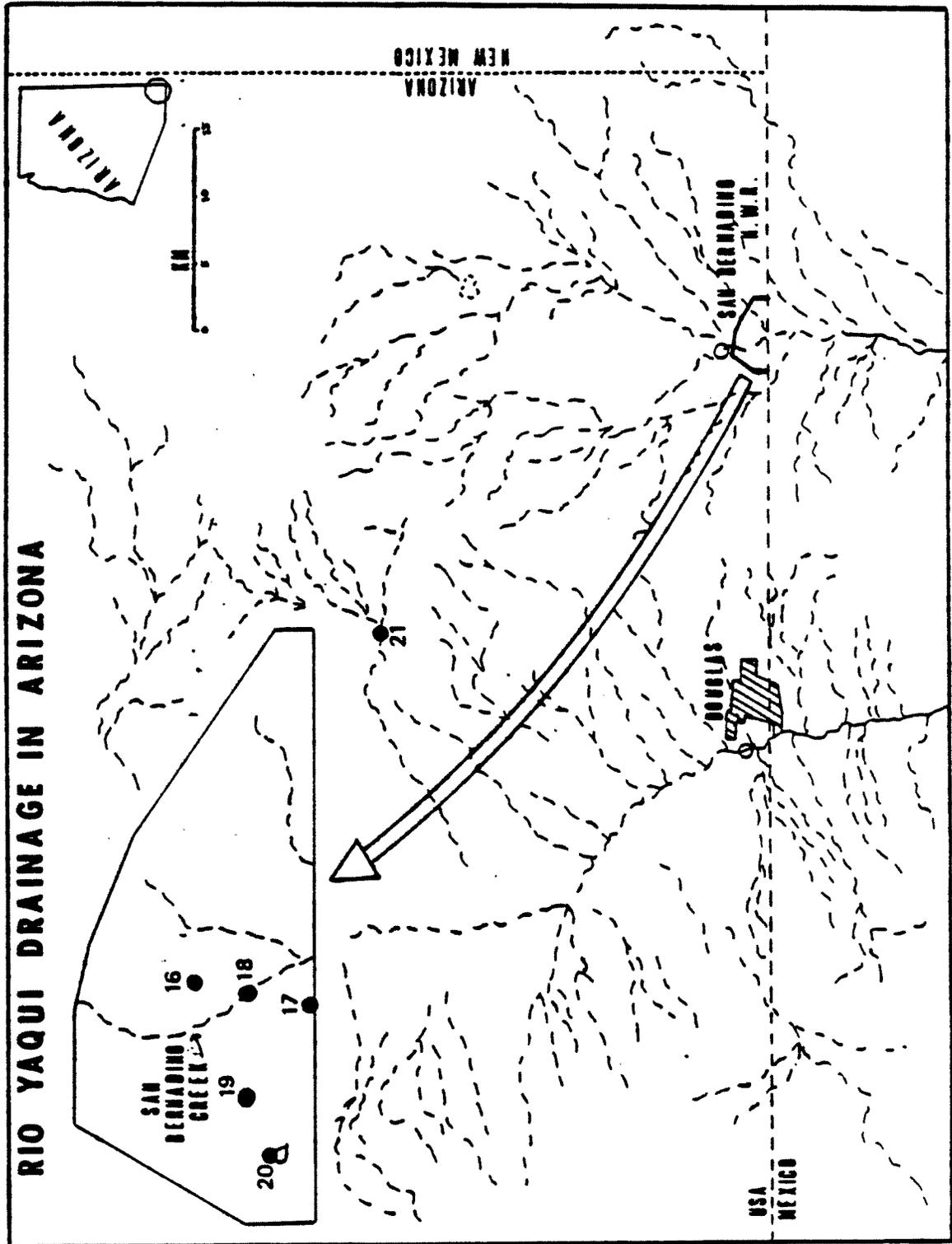


Figure 1. PRESENT AND HISTORIC DISTRIBUTION OF GILA TOPMINNOW

Solid circles indicate existing populations. Open circles indicate historic locations. Numbers refer to the listing on Table 1.

Figure 2. PRESENT AND HISTORIC DISTRIBUTION OF YAQUI TOPHINNOW IN U.S.A.

(Taken from Maffe et al. 1983) Solid circles indicate existing populations. Open circles indicate historic locations. Numbers refer to the listing on Table 1.



Yaqui topminnow - The Yaqui topminnow was originally abundant throughout the Rio Yaqui drainage in southeastern Arizona and in Sonora and Chihuahua, Mexico, (Hendrickson et al. 1980). In the United States the headwater area of the Rio Yaqui held Yaqui topminnow in Whitewater and Black draws and their associated springs and cienegas, presumably in abundant numbers. This subspecies remains abundant in Mexico.

Present Known Distribution and Abundance

Both subspecies of topminnow in the United States now occupy only a small remnant of their historic range, and population numbers of this once multitudinous species are so small and their habitats so tenuous, that there is a definite concern for the future survival of the species (Johnson and Rinne 1982).

Gila topminnow - The Gila topminnow is now known to occur naturally in only nine isolated localities (Fig. 1, Table 1) in the United States. A 350 square mile area of the Santa Cruz drainage lies in Mexico and essentially nothing is known of the status of the Gila topminnow in that area, but groundwater pumping throughout northern Sonora is believed to have eliminated any possible populations in that country. In addition, one U.S. locality has recently been reclaimed and five other localities restocked with topminnows. Information on these populations is summarized in Table 1.

All but one of the remaining natural locations of the Gila topminnow are in the Santa Cruz River system: Redrock Canyon, Cottonwood Spring, Monkey Spring, Sonoita Creek, Cienega Creek, Sheehy Spring, Sharp Spring, and the upper Santa Cruz River. Two additional locations are immediately tributary to the Gila River. One of these, Salt Creek, is a natural population, and the other, Bylas Springs, is a reclaimed population, having had a portion of it treated in March 1982 for elimination of mosquitofish. It was later restocked with topminnow; however mosquitofish persist despite the treatment.

Five apparently successfully stocked populations of Gila topminnow are located at Hidden Waters, tributary of the Salt River; the Boyce Thompson Arboretum, near Superior, Arizona; Seven Springs, tributary to the Gila River; Tule Creek, tributary to the Agua Fria River; and Cow Creek, tributary to the Agua Fria River.

Two natural and two stocked populations of Gila topminnow are known to have been extirpated within the last 5 years due to introduction of non-native fish and habitat loss. A population which was discovered in July 1978 in an artesian well outflow on private lands near Mammoth, Arizona, was extirpated by October 1978 due to springhead construction (McNatt 1979). A second natural population at Cocio Wash in the Santa Cruz River drainage was lost in 1982 because of green sunfish, and from mine spills from a mining operation upstream. Stocked populations at Tule Creek and at Seven Springs were lost to flooding in 1978. Both habitats were restocked, in September 1981 and July 1980 respectively, and appear to be doing well. Seven Springs and adjoining Cave Creek were also stocked several times in the late 1960's, but all attempts were terminated by loss of the population, presumably by flooding.

TABLE 1: STATUS OF EXISTING GILA AND YAQUI TOPMINNOW POPULATIONS IN THE UNITED STATES

Map #	Site	Elev. (ft.)	Temp. Regime	Physical Description	Ownership	Other Fishes (*=exotic)	Comments
<u>Natural Gila Populations</u>							
(1)	Monkey Spring	4,550	Constant, 27 + 1°C	Hard water spring; pool 130' by 3-10' leading to cement flume.	Rail-X Ranch	-----	Stable isolated population.
(2)	Cottonwood Spring	4,560	Constant, 26 - 31°C	Hard water spring; pool 100' by 1.5-10'.	Rail-X Ranch	-----	Stable isolated population, but with potential access to mosquitofish from Sonoita Creek.
(3)	Sheehy Spring	4,700	Fluctuating, 7- 27°C	Spring run 160', 2 pools, extensive cienega (marshland) habitat.	San Rafael Cattle Co.	<u>Gila intermedia</u> <u>*Gambusia affinis</u>	Steadily declining since <u>Gambusia invasion, 1977-1979</u> . Near extinction.
(4)	Sharp Spring	4,750	Fluctuating, 6 - 25°C	Spring run 2,000'; 18 pools, extensive cienega habitat.	San Rafael Cattle Co.	<u>*Gambusia affinis</u>	Both pure topminnow and mixed populations; stable for past 3 years.
(5)	Santa Cruz River	4,600	Fluctuating,	Intermittent stream, subject to flooding and drying.	San Rafael Cattle Co.	<u>Agosia chrysoaster</u> <u>Gila intermedia</u> <u>Pantosteus clarki</u> <u>*Gambusia affinis</u> <u>*Lepomis cyanellus</u>	Populations of both topminnow and mosquitofish are patchy and fluctuate both spatially and temporally.

Map #	Site	Elev. (ft.)	Temp. Regime	Physical Description	Ownership	Other Fishes (*=exotic)	Comments
<u>Natural Gila Populations</u>							
(6)	Redrock Canyon	4,600-4,250	Fluctuating	Intermittent stream, subject to flash flooding	U.S. Forest Service - Coronado NF	<u>Agosia chryso-gaster</u>	Small topminnow populations in highly fluctuating habitat.
(7)	Cienega Creek	4,300-3,950	Fluctuating	Permanent stream 7.5 mi. long; pools, riffles, springs.	Exxon Oil Co.	<u>Gila intermedia</u> <u>Agosia chryso-gaster</u>	Large, locally abundant population.
(8)	Sonoita Creek	3,600	Fluctuating	Permanent stream	Private owner	* <u>Gambusia affinis</u> <u>Agosia chryso-gaster</u> <u>Pantosteus clarki</u> <u>Rhinichthys osculus</u> <u>Carassius auratus</u> <u>Salmo spp.</u> <u>Micropterus salmoides</u> <u>Lepomis cyanellus</u> <u>Lepomis macrochirus</u> <u>Cyprinus carpio</u> <u>Ictalurus punctatus</u> <u>Ictalurus pricei</u> <u>Ictalurus melas</u> <u>Ictalurus natalis</u>	Rediscovery of topminnow in 6/82 following no reports of topminnow here since 1977, but population abundance and habitat are very unstable.
(9)	Salt Creek	2,500	Fluctuating	Single spring head and run; low pH at head.	San Carlos Indian Reservation	* <u>Gambusia affinis</u> <u>Notropis lutrensis</u>	Recently invaded by <u>Gambusia</u> and <u>Notropis</u> (winter 1978-1979?); topminnow persist in low numbers in head-spring.

Map #	Site	Elev. (ft.)	Temp. Regime	Physical Description	Ownership	Other Fishes (*=exotic)	Comments
<u>Renovated/Restocked Gila Populations</u>							
(10)	Bylas Springs	2,500	Fluctuating	Two spring runs fed by multiple spring heads.	San Carlos Indian Reservation	* <u>Gambusia affinis</u>	One spring recently invaded by <u>Gambusia</u> (Winter 1978-1979); topmin persist in low-moderate number Renovated 3/82 but failed to remove <u>Gambusia</u> Other spring and streams remains pure.
(11)	Boyce Thompson Arboretum	2,500	Fluctuating	Artificial pond, 15' dam across Queen Creek.	State of Arizona	<u>Cyprinodon macularius</u> * <u>Gambusia affinis</u>	First stocked early 1970's. Renovated late 1970's to eliminate black bullheads. <u>Gambusia</u> discovered in pond 7/21/83.
(12)	Hidden Waters	1,600	Fluctuating	Spring fed stream flow.	U.S. Forest Service - Tonto NF	<u>Agosia chrysogaster</u>	First stocked 1976. Most successful introduction to date. Abundant and stable.

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Map #	Site	Elev. (ft.)	Temp. Regime	Physical Description	Ownership	Other Fishes (*-exotic)	Comments
<u>Renovated/Restocked Gila Populations</u>							
(13)	Tule Creek	2,600	Fluctuating	Spring fed stream flow.	Bureau of Land Management and privately-owned lands	-----	First stocked in 1968, but topminnows were eliminated by flooding in 1978. Restocked 10/81. Abundant and stable.
(14)	Seven Springs	4,000	Fluctuating	Spring fed stream flow.	Forest Service (Tonto N.F.)	<u>Agosia chrysogaster</u>	First stocked here and adjacent to Joining Cave Creek late 1960s. Several attempts lost to flooding. Restocked stream in 1975, but eliminated by flooding 1978. Restocked spring 2/80. Abundant and stable.
(15)	Cow Creek	2,155	Fluctuating	Permanent stream	Privately-owned	<u>Agosia chrysogaster</u>	Stocked in 9/81. Abundant & stable.

Map #	Site	Elev. (ft.)	Temp. Regime	Physical Description	Ownership	Other Fishes (*-exotic)	Comments
<u>Rio Yaqui Populations</u>							
(16) and (17)	San Bernardino and Artesian Wells	3,750	Thermal, 22-29°C	Artesian bore springs; shallow, regulated flow.	U.S. Fish and Wildlife Service	<u>Gila purpurea</u>	Small, stable populations but habitat in danger of success- ion by encroach- ing vegetation.
(18)	San Bernardino Creek	3,750	Fluctuating	Intermittent stream/arroyo	U.S. Fish and Wildlife Service	<u>Agosia chrysogaster</u> <u>*Gambusia affinis</u>	<u>Gambusia</u> first recorded here in 6/80. Num- bers steadily increased since then.
(19)	Mesa (or Tule) Spring, San Bernardino NWR	3,750	Fluctuating	Natural spring outflow; heavily vegetated.	U.S. Fish and Wildlife Service	-----	Very small but stable topmin- now population.
(20)	House Pond San Bernardino NWR	3,750	Fluctuating	2.5 acre artificial pond.	Johnson Historical Society	<u>Gila purpurea</u> <u>*Gambusia affinis</u>	Topminnow near- ly extirpated by mosquitofish in 1980.
(21)	Leslie Creek	4,625	Fluctuating	Permanent stream.	Lamberson- Riggs Ranch	<u>Agosia chrysogaster</u> <u>Campostoma ornatum</u> <u>Gila purpurea</u>	Apparently sta- ble topminnow population in an approx. 650' stretch. Intro duced from Astin Spring in early 1970's.

1 through 7 and 15 through 19 - taken from Meffe et al. 1983.
8 - taken from Minckley et al. 1977.

9 and 10 - taken from Meffe et al. 1983. with comments revised from J. E. Johnson, pers. comm. 1982.

11 and 12 - taken from J. E. Johnson, pers. comm. 1982.
13 and 14 - taken from J. E. Brooks, pers. comm. 1983.

15 - taken from B. Kepner, pers. comm. 1983.

Yaqui topminnow - There are eight known locations where the Yaqui topminnow presently occurs in the United States (Figure 2 and Table 1). These are all within the native Yaqui River system headwater area, and all but one are now restricted to artesian springs and wells, ponds, and spring runs on the San Bernardino National Wildlife Refuge. The seven San Bernardino locations are House Pond, North Pond and Spring, Pipe Spring, Mesa (or Tule Spring), Cottonwood Spring, Border Spring, and San Bernardino Creek. The eighth population, at Leslie Creek, was introduced in the early 1970's from Astin Spring on the San Bernardino National Wildlife Refuge. The Astin Spring population was extirpated in 1969 when the spring was "trampled dry" by cattle (Minckley 1973). Current status of these populations is shown in Table 1. While the United States population of Yaqui topminnow is endangered, the subspecies is widespread and abundant throughout most of its range in Mexico (Hendrickson et al. 1980).

Reasons for Decline and Future Threats

Along with much of the native southwestern fish fauna, the topminnow has been declining since the late 1800's. The loss of aquatic habitats in the southwest due to man's activities has been well documented (Miller 1961, Minckley and Deacon 1968, Naiman and Soltz 1981). The Gila River system has been severely affected by civilization and contains only a small fraction of its pre-1860 aquatic habitat (Miller 1961). This system, prior to 1860, provided extensive habitat for the Gila topminnow. The major rivers were essentially perennial streams with stable channels and extensive lagoons, marshes and backwaters, and on the small tributaries there existed many springs and cienegas. These marshes, backwaters, springs and cienegas formed the major habitat of the Gila topminnow. The changing of the rivers and streams into intermittent, deeply cut, broad sandy washes, subject to severe flooding; and the loss of the backwaters, springs, marshes and cienegas due to lowering water tables, channel downcutting, damming, etc.; reduced the amount of habitat available to the topminnow and generally confined it to the remaining smaller streams, springs, and headwater areas. However, the topminnow persisted, and in the 1930's was still abundant throughout the drainage (Hubbs and Miller 1941).

In the late 1800's exotic fish species began to be introduced. Most of these non-natives preferred the faster, deeper mainstream waters and the newly developing reservoirs and had little effect on the topminnow in their shallow backwaters and springs where cover was abundant. But in 1926 the mosquitofish, Gambusia affinis, was introduced into Arizona waters (Minckley 1973) and has since spread rapidly throughout the Southwest. Because the mosquitofish is able to utilize the same habitat as the topminnow, it came into direct contact with the topminnow, and its aggressive, predatory nature led to sharp declines in the topminnow populations.

Gila topminnow - The mechanism by which G. affinis causes the decline and extinction of P. occidentalis appears to be predation, including direct predation on the juvenile topminnow and harrassment of the adult topminnow.

Adult topminnow receive extensive fin damage which often results in infection and death (Meffe et al. 1983). Because both species are livebearers, there is no competition for spawning sites. The food habits of the two species are different with topminnow mainly browsing on detritus and vegetation, and the mosquitofish feeding mainly on invertebrates and small fish (Schoenherr 1981).

The role of the mosquitofish in the decline of the topminnow has been well documented. In many cases the effect has been very rapid, such as in Arivaca Creek, Arizona, where Gila topminnow were introduced in 1936. They flourished and were abundant there by 1957, but were extirpated in less than 2 years due to the introduction of mosquitofish into the creek sometime after 1957 (Miller 1961). The extirpation of Gila topminnow occurred almost as rapidly in artesian springs and canals near Safford, Arizona, where topminnow were abundant in 1962, mosquitofish were introduced in 1963, and topminnow were gone by 1966 (Minckley and Deacon 1968). Minckley et al. (1977) report that between 1950 and May 1977 mosquitofish completely replaced Gila topminnow at 15 localities. Of the fifteen presently known Gila topminnow habitats, seven also contain mosquitofish, one of these despite recent treatment to eliminate mosquitofish (Table 1). Only two Yaqui topminnow habitats are presently inhabited by mosquitofish (House Pond and San Bernardino Creek); in both of these the topminnow populations are declining.

In some instances topminnow and mosquitofish have been able to coexist over a long period of time. The mechanism by which the balance between the two species is maintained in these particular instances is poorly understood, but appears related to periodic flooding, habitat complexity, and the presence of springhead refuges. Currently co-occurrence of Gila topminnow and mosquitofish is found in the upper Santa Cruz River, in Sharp Spring, tributary to the upper Santa Cruz (Meffe et al. 1981), and in Sonoita Creek (J.E. Johnson pers. comm.). Minckley et al. (1977) also reported co-occurrence at Sheehy Spring, but the topminnow population there is presently in danger of extirpation due to mosquitofish (Meffe et al. 1983). There are records of long term coexistence of topminnow and mosquitofish in the Gila River at Dome, Arizona, and in the Salt River at Tempe, Arizona (both sites are now dry), and in Tonto Creek upstream from Roosevelt Dam where both species existed for at least 10 years from 1941 to 1951 (Minckley et al. 1977). At Cottonwood Spring mosquitofish have failed to invade the spring, even though there was access from Sonoita Creek for at least 2 years, due to unique springhead chemistry (Minckley 1969a).

When the habitat is sufficiently large and complex, the two species can apparently maintain some segregation and coexistence can occur. Minckley et al. (1977) noted that in Sonoita Creek and the upper Santa Cruz River, coexisting topminnow and mosquitofish tended to segregate, with mosquitofish in quieter water and topminnow occupying moderate currents associated with shore, logs, or debris. They also surmised that topminnow may have

a selective advantage over mosquitofish in the springheads, since G. affinis rarely occupies springheads in either its introduced or native ranges. However, since 1977 mosquitofish have gained footholds in topminnow occupied springheads at Sheehy and Bylas Springs. It is also possible that isolated populations of topminnow continually disperse new individuals into the habitats which both species occupy, presenting the appearance of coexistence. Periodic flooding also appears to be a factor in coexistence of the two species, since the topminnow is adapted to such flooding and the mosquitofish is not (Meffe, pers. comm. 1982).

Yaqui topminnow - While habitat loss and predation by introduced mosquitofish are joint factors in the decline of the Gila subspecies, habitat loss has been the only factor implicated in the decline of the Yaqui subspecies in the United States until recently. Until 1979, mosquitofish were not reported in the Rio Yaqui system (Hendrickson et al. 1980). The Yaqui topminnow's decline has been due to water source manipulation such as that at Astin Spring which dried up due to cattle use (Minckley 1973), and to groundwater pumping that has altered spring and stream flows. However, the recent introduction of mosquitofish into two of the remaining U.S. Yaqui topminnow habitats (House Pond, San Bernardino Creek) is currently threatening those populations and potentially all of the San Bernardino National Wildlife Refuge populations.

The threat to the remaining Gila and Yaqui topminnow populations from mosquitofish and habitat destruction continues. The spread of G. affinis has continued virtually unchecked since its introduction in 1926, and this species has proven resistant to attempts to remove it from springs or streams. In addition to migratory dispersal throughout stream systems, mosquitofish continue to be introduced by State and county health departments and other agencies as a mosquito control agent, and by private citizens for bait or other purposes. Often the source of an appearance of mosquitofish in a stream or spring cannot be determined; they just suddenly are there and the topminnow begins an inexorable decline. Unless action is taken, the invasion of mosquitofish will continue and none of the remaining topminnow habitats are safe, as illustrated by the recent invasions of Sheehy Spring, Bylas Springs, Salt Creek, Boyce Thompson Arboretum, San Bernardino Creek and House Pond. This threat cannot ever be entirely eliminated; the primary defense is to expand the number of Gambusia-free locations of topminnow in order to buffer the effects of the temporary loss of one or more populations.

Habitat destruction as a continuing threat to the topminnow, while perhaps less inevitable, is no less of a danger. The ownership of the lands on which the remaining topminnow habitats are located has a large bearing on the extent of that threat. Private land, while often restricting public access and its resulting problems, is entirely under the control of the landowner and the status of the topminnow is subject to his attitudes, economic needs and uses of the land and water, with no recourse by the public or its agencies. Privately owned habitats are also subject to abrupt changes in ownership and subsequent changes in impact on, and status

of the topminnow. Public lands offer a certain amount of inherent legal protection to topminnow habitats through the agency's enabling legislation, the Endangered Species Act, and various other pieces of State and Federal legislation. However, on multiple-use public lands, conflicting resource uses such as grazing, mining, irrigation, timber, recreation, roads and public access often create major threats to the existence of topminnow populations and their habitats, and conflicting opinions by resource managers on the effects of such uses on aquatic habitats sometimes hinders protection of such species as the topminnow. In addition, public access makes illegal stockings of mosquitofish relatively easy compared to private lands. Indian reservation lands are essentially privately owned lands, although any actions taken by the Bureau of Indian Affairs are covered by the provisions of the Endangered Species Act.

Of the ten existing natural or reclaimed habitats of the Gila topminnow, two are located on the San Carlos Indian Reservation (Salt Creek and Bylas Springs), one is on federally owned land (Redrock Canyon-Coronado National Forest), and the remaining seven are on privately owned land. Of the four restocked Gila topminnow habitats, one is on State land (Boyce Thompson), two are on Federal lands (Seven Springs and Hidden Waters - Tonto National Forest), and one is partially on Federal and partially on private lands (Tule Creek). Of the eight existing locations of the Yaqui topminnow, one is located on private land (Leslie Creek), and the other seven are on land owned by the U.S. Fish and Wildlife Service (San Bernardino National Wildlife Refuge).

Ecology and Life History

Topminnow ecology has been studied primarily in the Gila subspecies; however, ecology of the Yaqui subspecies is believed to be quite similar (Minckley 1973). Habitat requirements for *P. occidentalis* are fairly broad; it prefers shallow, warm, fairly quiet waters, but can adjust to a rather wide range, living in quiet to moderate currents, depths up to 1.0 m (Meffe pers. comm. 1982) and temperatures from constant 26-28°C springs (Schoenherr 1977) to streams fluctuating from 6-37°C (Meffe et al. 1983). Topminnow live in a wide variety of water types; springs, cienegas, marshes, permanent streams, intermittent streams, and formerly along the edges of large rivers. Preferred habitat contains dense mats of algae and debris, usually along stream margins or below riffles, with sandy substrates sometimes covered with organic muds and debris (Minckley 1973). It has been reported by Meffe et al. (1983) that topminnow can tolerate almost total loss of water by burrowing into the mud for 1 - 2 days.

Topminnows can also live in a fairly wide range of water chemistries, with recorded pH's in existing habitats from 6.6 to 8.9, dissolved oxygen readings from 2.2 to 11 mg/l (Meffe et al. 1983), and salinities from tap water to sea water (Schoenherr 1974).

Topminnow food habits are also rather generalized and include bottom debris, vegetative materials, amphipod crustaceans and insect larvae, including mosquito larvae (Minckley 1973).

Topminnow life span is approximately 1 year, but appears to be linked to sexual maturation which in turn is dependent upon the time of year in which they were born. Schoenherr (1977) and Constantz (1974) both found that in constant temperature springs, breeding took place year-round and that individuals born in January or February bred by July and often died by September, whereas those born in summer or fall gave birth the following spring and lived approximately 1 year. Constantz (1979) also found that those living in fluctuating environments such as Cocio Wash did not mature for 12 months and that breeding took place only from April to August.

The onset of breeding and the brood size are affected by water temperature, photoperiod, food availability, and predation (Schoenherr 1977). The brood size varies from 1 to 20 in the Gila topminnow (Meffe, pers. comm. 1982) and from 6 to 49 in the Yaqui topminnow (Minckley 1973). Two broods are carried simultaneously, one much further developed than the other, and the gestation period is 24 to 28 days for the Gila topminnow and 12 to 15 days for the Yaqui topminnow (Minckley 1973).

Conservation Attempts

The major effort in preservation of the Gila and Yaqui topminnow to date has been the largely unsuccessful reintroduction into seemingly suitable sites within its historic range. Minckley (1969c) describes nine unsuccessful transplants of the Gila topminnow between 1964 and 1968, all of which were eliminated by mosquitofish, flooding and pesticides. Other transplants that have been tried have been unsuccessful or have not been followed up. Topminnow were distributed by the Arizona Department of Game and Fish for several years as mosquito control agents, but of seven sites checked in 1977 only one still retained topminnow (Johnson, pers. comm. 1982). Gila topminnow were introduced into Arivaca Creek, Arizona, as early as 1936 when they were apparently mistakenly planted by the Arizona State Health Department as mosquitofish (Miller 1961), but were later extirpated when mosquitofish actually were introduced. An introduced population survived in Tule Creek for 10 years before it was eliminated in 1978 by flooding (Collins et. al. 1981). It was restocked in September 1981 and is apparently successful. Several unsuccessful attempts have been made to stock Seven Springs and adjoining Cave Creek. The last stocking there was in 1980 and is still surviving. Other currently successful transplants include the Gila topminnow in Hidden Waters, Cow Creek, and the Boyce Thompson Arboretum, and the Yaqui topminnow in Leslie Creek.

Both Gila and Yaqui topminnow have also been successfully reared at the U.S. Fish and Wildlife Service Dexter National Fish Hatchery at Dexter, New Mexico. Hatchery reared topminnow are expected to provide a stock of fish for reintroduction into native habitats, although the cannibalism of juveniles noted by Meffe (1981) in the Dexter population may slightly reduce recruitment in the wild.

There are currently sufficient stocks of topminnow at the hatchery to support a multi-agency cooperative program of reintroduction of Gila topminnow into suitable habitats on Forest Service lands within its historic range. This program was initiated in September 1981 by signing of a memorandum of understanding between the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the Arizona State Game and Fish Commission. The memorandum of understanding covers an agreement between the three agencies to stock Gila topminnow in over 50 ponds, springs and streams within the historic range, on the Tonto, Coronado, Coconino, and Prescott National Forests. Sites will be selected by the Forest Service and stocking and monitoring done by the Arizona Game and Fish in cooperation with each other and the Fish and Wildlife Service. The memorandum provides for initiation of downlisting procedures when 20 populations have been successfully re-established for at least 3 years, and initiation of delisting when 50 populations have been successfully reestablished for at least 3 years or 30 populations for 5 years. Success of the introduced populations will be determined by a program of periodic monitoring of both fish and habitats; monitoring will be continued even after delisting to insure that the species remains abundant and widespread in both natural and stocked habitats. These reintroductions will establish experimental populations under the specification that their placement will not limit or alter existing water uses at the sites. Consultation under Section 7 of the Endangered Species Act will be done on the cooperative management plan currently being prepared for the program. Neither the memorandum of understanding nor the management plan have any affect on management of existing natural populations of Gila topminnow. This reintroduction program began actual transplantations in June 1982 with 65 sites receiving fish; the success of any of these new populations is yet unknown.

Another important conservation effort was the acquisition of the San Bernardino National Wildlife Refuge with its six existing Yaqui topminnow populations, by the U.S. Fish and Wildlife Service. The ranch was purchased in 1979 by The Nature Conservancy for the Fish and Wildlife Service when the private owner offered it for sale. It was feared that continued private ownership might jeopardize the future of the Yaqui topminnow in the United States. The Fish and Wildlife Service acquisition of the ranch from The Nature Conservancy was accomplished in April 1982. The ranch house and a small parcel of land, including House Pond, were sold to the Johnson Historical Society; however, the Fish and Wildlife Service has retained access to and control over all water and aquatic habitat on the entire ranch.

Removal of mosquitofish has recently been attempted in three topminnow locations. The San Bernardino House Pond was partially drained and treated with a piscicide in February 1980; however, mosquitofish reappeared in the pond following the treatment. Native Yaqui chubs (Gila purpurea) and Yaqui topminnows were stocked in House Pond in September 1980 in an attempt to control the mosquitofish biologically. That experiment is still ongoing, with all three species surviving. Bylas Spring was chemically

treated for mosquitofish eradiction in March 1982, but the effort failed to eliminate the exotic species. Black bullheads were successfully removed from the Boyce Thompson Arboretum topminnow habitat in 1979.

There is no existing recovery team for the Gila and Yaqui topminnow. Recovery efforts are progressing under the cooperation of the U.S. Fish and Wildlife Service, the land management agencies, and the State Game and Fish agencies.

PART II - RECOVERY ACTION PLAN

The primary objective of this recovery plan is to ensure the survival of the Gila and Yaqui topminnow in the wild, as self-sustaining and separate subspecies by:

1. Maintaining, protecting and enhancing existing natural topminnow populations.
2. Reintroducing topminnow into suitable sites throughout the historic range in order to establish self-sustaining populations.

As this objective is met, downlisting and delisting will be initiated under the following criteria:

Gila Topminnow;

1. Downlist when

- a. Twenty populations have been successfully reestablished in the wild, within historic range, and have survived for at least 3 years.

2. Before 1987 - Delist when

- a. At least 50 percent of the existing natural, reclaimed, or newly discovered natural populations have been secured through removal of and protection against invasion of mosquitofish and other predatory species, and through protection of the habitat by management plans, cooperative agreements, land acquisition, or other means.
- b. Fifty populations have been successfully reestablished in the wild, within historic range, and have survived for at least 3 years, or thirty populations have been successfully reestablished and have survived for at least 5 years.

After 1987 - Delist when

- a. Fifty populations have been successfully reestablished in the wild, within historic range, and have survived for at least 3 years, or thirty populations have been successfully reestablished and have survived for at least 5 years.

Yaqui Topminnow;

1. Delist when
 - a. There is complete Federal control of the San Bernardino Ranch aquatic habitat.
 - b. Mosquitofish and other exotic predators have been eliminated from all seven existing San Bernardino Ranch habitats, protection against future exotic fish invasion has been established, and topminnow populations in these habitats are stable and secure.
 - c. Stable populations of topminnow have been successfully re-established in all suitable existing and reclaimed San Bernardino Ranch habitats and have survived for at least 5 years.

STEP-DOWN OUTLINE

- 1.0 Maintain, protect and enhance existing natural populations of Gila and Yaqui topminnow.
 - 1.1 Monitor existing populations and their habitats.
 - 1.11 Recommend timing, frequency, and duration of monitoring.
 - 1.12 Establish minimum data to be collected on populations and habitats.
 - 1.13 Collect data.
 - 1.14 Provide for data distribution.
 - 1.2 Manage existing habitats on publicly owned lands.
 - 1.21 Develop and implement habitat management plans for all existing topminnow habitats.
 - 1.211 Regulate land and water uses for the benefit of the topminnow.
 - 1.212 Enhance and improve existing habitats.
 - 1.213 Prevent introduction or invasion of non-native fishes into existing topminnow habitats.
 - 1.2131 Build and maintain barriers against invasion by non-native fishes.
 - 1.2132 Prohibit the introduction of Gambusia affinis and other non-native fishes into topminnow habitats.

- 1.2133 Petition the Arizona Game and Fish Department to remove Gambusia affinis as a legal baitfish in the State of Arizona.
- 1.214 Remove Gambusia affinis and/or other undesirable non-native fishes from topminnow habitats when detrimental.
- 1.22 Review and comment on all proposed projects which might affect topminnow or their habitat on publicly owned lands.
- 1.3 Manage existing habitats on privately owned lands, cooperatively with landowners.
 - 1.31 Obtain management rights through cooperative management agreements, conservation easements, incentive programs, fee simple purchases, etc.
 - 1.32 Develop and implement habitat management plans for all existing topminnow habitats (see 1.21).
- 2.0 Continue surveying waters in the Gila River drainage and the United States portion of the Yaqui River drainage for undiscovered populations of topminnow.
 - 2.1 Identify areas of high potential.
 - 2.2 Recommend means of surveying.
 - 2.3 Protect any populations found.
- 3.0 Maintain stocks of both Gila and Yaqui topminnow at Dexter National Fish Hatchery and Gila topminnows alone at Boyce Thompson Arboretum.
- 4.0 Reintroduce Gila and Yaqui topminnow into suitable sites within the United States portion of their historic ranges.
 - 4.1 Enter into a cooperative agreement with public agencies for the reintroduction of topminnow onto public lands.
 - 4.11 Develop evaluation criteria for site selection.
 - 4.12 Survey, evaluate, and select potential sites.
 - 4.13 Prepare selected sites, if necessary.
 - 4.14 Transplant topminnow into the selected sites.
 - 4.15 Monitor the transplanted populations and their habitat (See 1.1).
 - 4.151 Recommend timing, frequency, and duration of monitoring.

- 4.16 Prepare habitat management guidelines for topminnow reintroduction sites.
 - 4.17 Develop and refine a Topminnow Habitat Profile.
 - 4.18 Manage the habitat of reintroduced populations (see 1.2)
- 4.2 Work with private landowners to obtain rights to reintroduce and manage topminnow on private lands.
- 5.0 Initiate and support further studies of the Gila and Yaqui topminnow.
- 5.1 Study the mechanisms of topminnow-mosquitofish coexistence.
 - 5.2 Study the effects of cannibalism of juveniles noted in hatchery and laboratory stocks of topminnow.
 - 5.3 Study the relationships between topminnow populations and multiple use management, particularly livestock grazing.
- 6.0 Enforce all State and Federal laws protecting topminnow populations and their habitat.
- 7.0 Develop public support through an information and education program.
- 7.1 Develop an interpretive program at the San Bernardino National Wildlife Refuge.
 - 7.2 Develop a program of contact with and education of private landowners.
 - 7.3 Encourage the use of topminnow as mosquito control agents within historic range.
 - 7.4 Prepare an information pamphlet.
 - 7.5 Develop a slide talk.
 - 7.6 Provide information to the news media.
 - 7.7 Display populations of topminnow at locations within their historic range.

NARRATIVE

The objective of this recovery plan is to restore the Gila and Yaqui topminnow as secure and stable members of the native fish fauna of the Gila and Yaqui River systems. The actions just outlined should accomplish this goal, through fulfillment of the criteria established for downlisting and delisting of the topminnow. However, delisting of the species should not be viewed as the end of the effort toward the recovery of the topminnow. After delisting is accomplished, monitoring of the populations should continue to ensure that the species does not once again decline, and opportunities to further enhance and expand the topminnow should be sought and exploited.

1.0 Maintain, protect and enhance existing natural populations and habitats of the Gila and Yaqui topminnow.

It is important to the preservation of the topminnow to protect the remaining natural or reclaimed populations, thereby preserving the basic wild genomes. Only these seventeen existing topminnow habitats (10 Gila topminnow, 7 Yaqui topminnow) are definitely known to possess all the necessary requirements for topminnow survival. Therefore, strong attempts must be made to protect the existing natural localities. To do this requires a continuing program of monitoring and management.

1.1 Monitor existing populations and their habitats.

A monitoring program is necessary to document conditions and trends of existing populations and their habitats. It is important that monitoring personnel be capable of distinguishing topminnow from mosquitofish. An effort should be made to provide for continuity and standardization in the monitoring procedures, time of year, minimum data collected, personnel qualifications, record storage, and agency responsibilities.

1.11 Recommend timing, frequency, and duration of monitoring.

It is recommended that all existing populations be monitored at least once each year in mid- to late summer, when population numbers are usually at their highest. Monitoring should continue yearly until delisting, after which the frequency may be decreased, although periodic monitoring should continue.

1.12 Establish minimum data to be collected on populations and habitats.

The primary purpose of monitoring should be to determine the relative abundance of topminnow from year to year, to obtain an absolute determination of the fish species

present, particularly the presence or absence of Gambusia affinis, and to document the existing habitat conditions and the uses of the land and water. Fish monitoring will necessitate actual physical sampling of the fish and it is recommended that either a photographic record be made of the fish sampled or that a representative sample of fish be collected and preserved. Habitat monitoring will establish baseline data and document trends in habitat change.

1.13 Collect data.

The Arizona Department of Game and Fish should be the lead agency in the monitoring of existing topminnow populations.

1.14 Provide for data distribution.

It is recommended that an annual compilation and analysis of the monitoring data be sent to all concerned agencies and individuals as soon as it is available.

1.2 Manage existing habitats on publicly owned lands.

Management of topminnow habitat on publicly owned lands should be done through existing agency management procedures and should accomplish all of the following objectives.

1.21 Develop and implement habitat management plans for all existing topminnow habitats.

Habitat management plans should be prepared for all topminnow habitats, to coordinate the various agency efforts and to establish goals and objectives for future work. Once prepared, these plans should be implemented.

1.211 Regulate land and water uses for the benefit of the topminnow.

Any detrimental human activities and uses of land and water in existing topminnow habitats should be identified and methods formulated to alleviate the impact. The effects of such activities as grazing, mining, public access, bait fishing, etc., should be carefully analyzed and regulated to minimize the negative effects.

1.212 Enhance and improve existing habitats.

Any potential within existing habitats for sustaining larger, healthier topminnow populations should be analyzed, and improvement or enhancement measures

should be taken. Examples of potential improvements which have already been identified are: continuation of the program at Redrock Canyon to construct deflector dikes and ponds to create a more desirable pool-riffle structure (USFS); halting and repair of erosion in San Bernardino Creek, including a small instream structure at the southern border for erosion and mosquitofish migration control; and restoration of cienega habitats on the San Bernardino National Wildlife Refuge (FWS). Proposals for habitat improvements should be carefully examined for feasibility and effectiveness before implementation, and followup should be conducted to ensure their continuing effectiveness and repair.

1.213 Prevent introduction or invasion of non-native fishes into topminnow habitats.

1.2131 Build and maintain barriers against invasion by non-native fishes.

All topminnow habitats should be studied for the feasibility of barrier construction to prevent the incursion of Gambusia and other non-native fish species. Sites which have not been contaminated with mosquitofish and contain only topminnow should receive the highest priority. Once in place, barriers should be periodically inspected and maintained.

1.2132 Prohibit the introduction of Gambusia affinis and other non-native fishes into topminnow habitats.

It is essential that introductions of Gambusia into topminnow habitats and connecting waters be prevented. All agencies should be made aware of the importance of this prohibition and should work toward the establishment of stronger regulations and enforcement. A program should be established to make the public and landowners aware of these restriction and the need for them.

1.2133 Petition the Arizona Game and Fish Department to remove Gambusia affinis as a legal baitfish in the State of Arizona.

Introduction of exotic fish species often occurs through the use of those species as baitfish. Gambusia affinis is presently a legal baitfish in Arizona. Removal of Gambusia affinis from the legal state baitfish category may help alleviate indiscriminate transplanting of mosquitofish.

1.214 Remove *Gambusia affinis* and/or other undesirable non-native fishes from topminnow habitats when detrimental.

In the past, *G. affinis* has been thought to be incompatible with *P. occidentalis* to the point of total exclusion. While this may, in fact, be true, recent data indicate that under certain conditions both species may co-exist for prolonged periods (Minckley et al. 1977; Meffe et al. 1981). Therefore, at this time, an automatic renovation of topminnow/mosquitofish populations in all cases is not recommended. The impact of the exotic on the native species should be assessed on a case by case basis and the habitat renovated only if *Gambusia* seems to jeopardize the continued existence of the topminnow population.

At present, mosquitofish are found in conjunction with topminnows in Sheehy Spring, Sharp Spring, Boyce Thompson Arboretum, the upper Santa Cruz River, Bylas Springs, Salt Creek, Sonoita Creek, San Bernardino Creek, and House Pond. In order to prevent further deterioration and initiate recovery of topminnow populations, it is recommended that attempts be made to remove *G. affinis* from all of the above sites except Sharp Spring, the Santa Cruz River and Sonoita Creek. The Santa Cruz River, Sonoita Creek, and Sharp Spring are not recommended for renovation at this time, because of the prolonged coexistence of topminnow and mosquitofish, the complexity of their systems, and the presence of other native fish species.

It is also recommended that mosquitofish be removed from all stock ponds and other waters within the Redrock Canyon drainage to prevent their possible spread into the creek.

1.22 Review and comment upon all proposed projects which might affect topminnow or their habitat on publicly owned lands.

In order to effectively manage topminnow habitat, it will be necessary to be aware of any proposed projects which might affect topminnow or their habitat. Such projects and activities on publicly owned lands, or that are funded, authorized or conducted by a Federal agency on privately owned lands, should be reviewed by State, Federal, and interested biologists, and be in compliance with State and Federal laws and regulations, as well as being subjected to consultation with the Fish and Wildlife Service as required by Section 7 of the Endangered Species Act.

1.3 Manage existing habitat on privately owned lands cooperatively with the landowners.

1.31 Obtain management rights through cooperative management agreements, conservation easements, incentive programs, fee simple purchase, etc.

To provide for the maintenance of topminnow populations on privately owned lands, it will be necessary to obtain the cooperation and good will of the private landowner. Once a working relationship is established, cooperative management agreements should be negotiated to acquire protection for the topminnow and its habitat through memoranda of understanding, cooperative agreements, conservation easements, incentive programs, or purchase.

Agreements and easements should provide, as a minimum, basic protection of existing topminnow habitat and access to the sites by management agencies, and are strongly encouraged over outright purchase of the habitats. If possible, such agreements should also provide for management rights to improve and enhance existing sites, and to eradicate Gambusia and other non-native fishes.

Ownership of the privately owned topminnow sites is given in Table 1. Some of the landowners are, at present, much more likely to respond favorably to proposals for cooperative agreements, and therefore, should be given priority. In particular, Mrs. F. Sharp of the San Rafael Cattle Company has shown a great deal of cooperation and interest in the topminnow and should be approached in the near future about an agreement on topminnow habitat in the San Rafael Valley. Another strong possibility for a cooperative agreement exists on Cienega Creek Ranch. Land along the creek was recently purchased by Exxon Company which may be receptive to the favorable publicity involved in an agreement to protect topminnow. Because of the paucity of sites outside the San Bernardino National Wildlife Refuge for the Yaqui topminnow, the Lamberson-Riggs Ranch should be approached in an effort to obtain an agreement for topminnow habitat management on Leslie Creek.

At present, only the San Bernardino Ranch has been identified for public acquisition and that has been accomplished. Other privately owned sites can best be protected via easements and agreements.

1.32 Develop and implement habitat management plans for all existing topminnow habitats.

As agreements with private landowners are reached, habitat management plans should be prepared for all topminnow habitats. These plans should establish goals and objectives for management of the habitats (see 1.21).

2.0 Continue surveying waters in the Gila River drainage and the United States portion of the Yaqui River drainage for undiscovered populations of topminnow.

The Gila River drainage and United States portion of the Yaqui River drainage cover almost the entire south half of the state of Arizona and a large portion of southwestern New Mexico. Many of the small springs, seeps, cienegas and other isolated aquatic habitats in these drainages have never been mapped, much less surveyed for topminnow. It appears likely, given their original widespread abundance and the fact that populations continue to be unexpectedly discovered (Johnson and Kobetich, 1968; McNatt, 1978; Rinne, et al., 1981; Meffe, et al., 1982), that additional undiscovered topminnow locations still exist. These locations should be identified, protected, and added to the monitoring system.

2.1 Identify areas of high potential.

A brief survey of those people knowledgeable of southwestern fishes yielded an initial list of high potential areas for further survey for topminnow. These areas include: the San Pedro River drainage south of Mammoth, Arizona; the headwaters of the Redrock Canyon drainage; the San Carlos Indian Reservation, particularly along the Gila River near Bylas; the San Rafael Valley foothills; the east side of the Santa Rita Mountains; the Santa Cruz River in Mexico, and the Swisshelm Mountains. Other likely areas may exist and should be identified.

2.2 Recommend means of surveying.

To facilitate the extensive surveying which is required, it is recommended that much of the survey be conducted initially from the air. Small aquatic sites which are difficult, if not impossible, to sight in other ways could be located, and sampled later.

2.3 Protect any populations found.

Any newly discovered populations of topminnows should be protected, monitored and managed as outlined in section 1.0.

3.0 Maintain stocks of Gila and Yaqui topminnow at Dexter National Fish Hatchery.

Since the emphasis of the recovery effort for topminnow is the reintroduction program, and this program is dependent upon the availability of large numbers of topminnow for transplanting, it is recommended that the topminnow stocks be maintained at Dexter National Fish Hatchery until delisting of each subspecies has been achieved. Following delisting a reevaluation of the need for further maintenance of hatchery stock should be conducted and recommendations made. To reduce the problem of inbreeding and to maintain genetic diversity, new individuals should be brought into Dexter at least every other year and added to the existing population.

4.0 Reintroduce Gila and Yaqui topminnow into suitable sites within the United States portion of their historic ranges.

While maintaining the existing topminnow populations will assure survival of the species, in order to restore the species to secure, self-sustaining status and remove it from the endangered species list, it will be necessary to reestablish it into habitats throughout its native range. For removal from endangered status, it is recommended that at least 50 successful reintroductions of Gila topminnow occur, and that Yaqui topminnow must be successfully reintroduced into all suitable habitats on the San Bernardino National Wildlife Refuge.

4.1 Enter into cooperative agreements with public agencies for the reintroduction of topminnow onto public lands.

Because of the potential restrictions of management options on land and water uses involved in dealing with a federally listed species, some of the multiple use land management agencies have shown a reluctance to allow reintroduction of such species onto their lands. To avoid such problems, the Forest Service, Fish and Wildlife Service, and the Arizona Department of Game and Fish signed a memorandum of understanding in September 1981 which declared reintroduced populations on National Forest lands in Arizona to be experimental, and that existing water uses at the reintroduction sites would not be limited or altered by the presence of topminnow. These reintroductions are expected to start in 1982. It is recommended that similar agreements be negotiated to cover possible reintroduction efforts for Gila topminnow in New Mexico and on BLM lands, and for Yaqui topminnow on Forest Service lands. A number of potential reintroduction sites have already been identified on public lands in the BLM Safford and Phoenix Districts.

4.11 Develop evaluation criteria for site selection.

It is recommended that any site which meets the following criteria be considered a potential site for topminnow

reintroduction. The site must be within the probable historic range of the subspecies; it must have permanent water; it should be below 4,000 ft. elevation unless there is thermal water; it must have shallow, vegetated waters; it must have sufficiently good water quality to support a variety of insect life and vegetation; it should be protected from major reoccurring flash flooding; and it should not have land and water uses which might adversely affect the survival of the topminnow. Preferred sites should also be lacking in predatory and competitive species, with preferably no non-native fish species present; be relatively isolated from human use and from the possibility of contamination by mosquitofish; and should have some degree of thermal stability. Size of the water is not a major factor, and very small aquatic areas (<1m²) should be considered if they possess permanent water of suitable quality.

4.12 Survey, evaluate, and select potential sites.

Extensive surveys should be conducted to select and prioritize potential reintroduction sites so that the primary reintroduction effort will occur in the most favorable sites. Highest priority sites should have: permanent water, no non-native fish, possess a barrier or isolation against mosquitofish, and be thermally stable. Sites which require habitat enhancement or removal of undesirable species should receive a lower initial priority, but be considered for later stocking. Baseline data on the characteristics of the site, the uses, and the habitat condition should be recorded for each site selected for reintroduction.

4.13 Prepare selected sites.

Remedial or enhancement actions which are necessary to bring a selected site up to or above the standards set in section 3.11 should be carried out prior to the actual reintroduction. Each selected site should be carefully examined and any needed actions taken.

4.14 Transplant topminnow into the selected sites.

Following the selection and enhancement (if necessary) of selected sites, topminnow should be transplanted into those sites. Stocks of Gila topminnow should be obtained from Dexter National Fish Hatchery. Stocks of Yaqui topminnows should come from Dexter NFH or springs on San Bernardino NWR east of San Bernardino Creek. Each subspecies should be reintroduced only into its respective historic

range. Transplantation should be carried out when habitat conditions are most favorable (April - June), and when populations are abundant and reproducing.

4.15 Monitor the transplanted populations and their habitat.

Each transplanted population must be carefully monitored to determine the success or failure of each population, and the reasons for the failure if it occurs. As with the monitoring of the natural populations, it is recommended that a program be developed to assure continuity in the monitoring and the collection of a standard set of minimum data.

4.151 Recommend timing, frequency, and duration of monitoring.

Reintroduced populations should be monitored at least once each year, in August/September, for 3 years following transplantation to determine success in establishment and in reproduction. After 3 years, monitoring should be reduced to once every other year, and should continue until delisting is accomplished. Following delisting, periodic monitoring should continue with each population being checked at least once every 5 years. All monitoring should follow procedures discussed in 1.1. Stocked populations that have failed should be evaluated for cause of failure, and either reintroduced from nearby topminnow sources of known purity or removed from further consideration as possible stocking sites.

4.16 Prepare habitat management guidelines for topminnow reintroduction sites.

It is recommended that habitat management guidelines be developed for the sites into which topminnow have been reintroduced.

4.17 Develop and refine a Topminnow Habitat Profile.

Because the present knowledge of the habitat requirements of topminnow is rather incomplete, it is recommended that during reintroduction efforts, a set of criteria for use in selecting potential topminnow habitat be developed. Data collected in site selection and in monitoring of the transplants should form the basis of this profile, with monitoring of failing transplants and analysis of the causes of failure forming a major part. As the profile

is developed, it will be used in evaluation of sites for further transplants. It is recommended that the Fish and Wildlife Service coordinate this action.

- 4.2 Obtain rights to reintroduce and manage topminnow on private lands through cooperative management agreements, conservation easements, fee simple purchase, etc.

Much of the historic habitat of Gila topminnow is on privately owned land. If this large segment of potential habitat for topminnow reintroduction is to be utilized, it will be necessary to obtain the cooperation and good will of the landowners. Cooperative agreements with the landowners should be obtained, allowing surveying for sites, introduction of topminnow, and future habitat management. Following the establishment of these agreements, the same procedure as outlined in section 3.1 should be followed.

- 5.0 Initiate and support further studies of the Gila and Yaqui topminnow.

The following studies are recommended:

- 5.1 Study the mechanisms of topminnow-mosquitofish coexistence.

The mechanisms of and circumstances under which topminnow and mosquitofish can coexist on a long term basis are poorly understood. A better understanding of this phenomenon would be helpful in the management of topminnows. Of particular importance would be further study of the interaction of the Yaqui topminnow and mosquitofish. This subspecies has not been as heavily studied as the Gila and whether or not it is as sensitive to mosquitofish predation is not entirely known.

- 5.2 Study the effects of the cannibalism on juveniles noted in hatchery and laboratory stocks of topminnow.

Wild stocks of topminnow are not known to show cannibalism of young in field conditions; however, it appears that such cannibalism may be induced by overcrowding in laboratory situations (Meffe 1981). Topminnows at Dexter National Fish Hatchery appear to have developed a cannibalistic habit, apparently from the high density rearing conditions in the hatchery. It is important to the reintroduction effort to study this effect and determine its endurance in the wild and its effects on transplant success.

- 5.3 Study the relationships between topminnow populations and multiple use management, particularly livestock

The impacts on topminnows of many of the resource uses occurring on lands bordering topminnow habitat is not very well known. Live-

stock grazing, in particular has had a significant impact on the riparian zones of several topminnow habitats; however, it is not known to what extent this impact is reflected in the topminnow populations. Because many of the future reintroductions will take place on multiple use public lands, it would be valuable to have a better understanding of the relationships involved.

6.0 Enforce all State and Federal laws protecting topminnow populations and their habitat.

Both the Gila and the Yaqui topminnow are protected by the Department of the Interior and by the State of Arizona, and the Gila topminnow is protected by the State of New Mexico. All pertinent laws and regulations should remain in effect until the species is delisted and secure. All agencies and groups concerned with the topminnow should be advised of the applicable regulations and their responsibilities in upholding them.

7.0 Develop public support through an information and education program.

An aware and informed public is a valuable asset in the protection and recovery of any species and can provide support for reintroduction efforts and can increase compliance with applicable laws and regulations. Toward that end, a program should be initiated to provide and disseminate information on topminnow status and recovery efforts.

7.1 Develop an interpretive program at the San Bernardino National Wildlife Refuge and other public areas.

The primary reason for the acquisition of the San Bernardino Ranch by the Fish and Wildlife Service was to protect and restore the native fish fauna, including the Yaqui topminnow. Therefore, it is recommended that an interpretive program for the ranch be developed to provide information on these species and to explain the importance and role of native species in the ecosystem.

7.2 Develop a program of contact with and education of private landowners.

Because the majority of presently existing Gila topminnow sites are located on privately owned land, it is important that the landowner be aware of the fish, their biology and their value, and that the agencies maintain a positive relationship with the landowner.

7.3 Encourage the use of topminnow as mosquito control agents within their historic range.

The current status of the topminnow as an endangered species

limits its present use in any mosquito control program. Some use of topminnow in mosquito control may be possible under the experimental population concept, if the introductions will further the conservation of the species, and subject to limited protection under the Endangered Species Act, as amended. However, when recovery has been sufficiently accomplished to result in delisting, a program should be initiated to encourage the use of topminnow for mosquito control, rather than mosquitofish. This program should be limited to historic range of the topminnow, with careful controls to prevent the planting of topminnow outside its range, and to prevent intermixing of the two subspecies.

7.4 Prepare an information pamphlet.

A pamphlet should be prepared providing information on the topminnow, its biology, and the recovery effort, for use in schools, public groups, and as part of the San Bernardino National Wildlife Refuge interpretive program.

7.5 Develop a slide talk.

A slide talk covering Gila and Yaqui topminnow, their history and their recovery effort should be prepared for use in schools, civic, conservation, and other groups, and in the San Bernardino program.

7.6 Provide information to the news media.

Press releases should be made to keep the public informed of major events in the topminnow recovery effort.

7.7 Display populations of Gila topminnow at locations within their historic range.

Populations may be displayed for public information at locations within historic range, such as the Arizona Sonora Desert Museum and the Phoenix Zoo, as long as precautions are taken to prevent escape into the wild.

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PART III - IMPLEMENTATION SCHEDULE

Priorities in column four of the implementation schedule are assigned using the following guidelines:

- Priority one (1) - Those actions absolutely necessary to prevent extinction of the species.
- Priority two (2) - Those actions necessary to maintain the species' current population status.
- Priority three (3) - All other actions necessary to provide for full recovery of the species.

Abbreviations used:

AGFD	Arizona Game and Fish Department
USFS	United States Forest Service
BLM	USDI Bureau of Land Management
NMGF	New Mexico Department of Game and Fish
FWS	USDI Fish and Wildlife Service
SE	Office of Endangered Species
LE	Law Enforcement
WR	Wildlife Resources
FR	Fishery Resources

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY			FISCAL YEAR COSTS (EST.)			COMMENTS
					FWS REGION (6)	PROGRAM (6a)	OTHER (7)	FY 1 (8)	FY 2	FY 3	
M4	Prevent introduction of exotic fishes	1.2132	1	ongoing			AGFD	existing funding			
M4	Remove <u>G. affinis</u> from Bylas Spring and Salt Creek	1.214	1	2	2	SE	BIA	1,000			AGFD and San Carlos Apache Tribe*
M4	Remove <u>G. affinis</u> from Boyce Thompson Arboretum	1.214	1	1	2	SE	AGFD	3,000			AZ State Parks & the Boyce Thompson Southwestern Arboretum, Inc.
M4	Remove <u>G. affinis</u> from San Bernardino Creek and House Pond	1.214	1	1	2	SE	AGFD	3,000			
I 1 & 2	Monitor populations and habitat	1.1	2	ongoing	2	SE	AGFD	2,500	2,500	2,500	
M3	Develop habitat management plans (public lands)	1.21	2	2	2	WR, SE	USFS BLM	3,000	3,000		
M3	Erosion control in San Bernardino Creek	1.212	2	3	2	WR		250,000			
M3	Obtain cooperative management agreements for private topminnow sites	1.31	2	3	2	SE	AGFD	1,000	1,000	1,000	
M1	Maintain stocks at Dexter NPH	4.0	1	ongoing	2	FR		5,000	5,000	5,000	

*Interested agencies.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY		FISCAL YEAR COSTS (EST.)			COMMENTS	
					FWS REGION (6)	OTHER PROGRAM (6a)	OTHER (7)	FY 1 (8)	FY 2 (8)		FY 3 (8)
M3	Develop habitat management plans for private sites with cooperative agreements	1.32	2	ongoing	2	SE	AGFD	300	300	300	(9)
R 9 & 10	Study mechanisms of topminnow/mosquito-fish coexistence	5.1	2	3	2	SE		15,000	15,000	15,000	
02	Law enforcement	6.0	2	ongoing	2	LE	AGFD NMGF USFS BLM	existing funding			
M3	Construct deflection dikes and ponds in Redrock Canyon	1.212	3	2			USFS	15,000	20,000		
M3	Restoration of cienega habitats on San Bernardino MNR	1.212	3	ongoing	2	WR		20,000	10,000	10,000	
I6	Survey for undiscovered populations	2.0	3	ongoing			NMGF AGFD	5,000	5,000		
R3	Develop topminnow Habitat Profile	3.17	3	5	2	SE	AGFD	10,000			

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY		FISCAL YEAR COSTS (EST.)			COMMENTS (9)
					FWS REGION (6)	OTHER PROGRAM (6a)	FY83 (8)	FY84 (8)	FY85	
M2	Obtain cooperative agreements for reintroduction on BLM lands in AZ and on BLM and FS lands in NM.	3.1	3	1	2	SE	BLM ACFD FS NMGF	existing funding		
I13	Survey for and select potential reintroduction sites.	3.11 3.12	3	3	2		USFS BLM ACFD NMGF	3,000	3,000	3,000
M2	Prepare selected sites	3.13	3	ongoing	2		USFS BLM ACFD NMGF	10,000	10,000	10,000
M2	Reintroduce P. occidentalis into selected sites.	3.14	3	ongoing	2	SE	ACFD NMGF	5,000	5,000	5,000
I 1 & 2	Monitor reintroduced populations and their habitats.	3.15	3	ongoing			ACFD NMGF	7,500	7,500	7,500

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY		FISCAL YEAR COSTS (EST.)			COMMENTS	
					FWS	OTHER	FY83 (8)	FY84	FY85		
					REGION (6)	PROGRAM (6a)					
M3	Develop habitat guide- lines for reintro- duced populations	3.16	3	1	2	SE	USFS BLM	10,000			(9)
A3	Obtain cooperative agreements for reintroduction onto private lands.	3.2	3	ongoing	2	SE	AFGD NMGF	existing funding			
R7	Study effects of cannibalism	5.2	3	1	2	SE		10,000	10,000		
R4	Study topminnow/ multiple use manage- ment relationships	5.3	3	2	2	SE	USFS BLM AGFD NMGF	10,000	10,000	10,000	
O1	Develop an interpre- tive program for native fish at San Bernardino MWR	7.1	3	1	2	WR			5,000		
O1	Develop public infor- mation program (slide talk, pamphlet, news releases	7.4 7.5 7.6	3	1	2	SE	AGFD NMGF			3,500	

PART IV - COMMENTS AND RESPONSES

Letters of comment on this plan have been reproduced in this section, followed by an outline of the responses made to each comment.



Overall, the plan is well written and will assist in clarifying recovery procedures for the Gila and Yaqui topminnows. Thank you for the chance to comment.

Sincerely


Bud Bristow
Director

BB:JEB:mk

Enc.

State of New Mexico



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STATE GAME COMMISSION
 EDWARD MUNOZ, CHAIRMAN
 GALLUP
 J W JONES
 ALBUQUERQUE
 BILL LITTRELL
 CIMARRON
 JAMES H. KOCH
 SANTA FE

GOVERNOR
 TONEY ANAYA
 DIRECTOR AND SECRETARY
 TO THE COMMISSION
 HAROLD F. OLSON

DEPARTMENT OF GAME AND FISH

STATE CAPITOL
 SANTA FE
 87503

April 20, 1983

Mr. Conrad A. Fjetland
 Assistant Regional Director (AFF)
 U. S. Fish and Wildlife Service
 P. O. Box 1306
 Albuquerque, New Mexico 87103

Dear Mr. Fjetland:

- B.1 Attached is a copy of the "Agency Review Draft Recovery Plan for Gila and Yaqui
- B.2 topminnow, (Poeciliopsis occidentalis Baird and Gerard)", with our editorial
- B.3 comments. The technical content seems accurate; however, the action plan is poorly written and de-emphasizes recovery activities for the Gila topminnow in New Mexico. We feel that the criteria for selecting reintroduction sites are unrealistic, at least for potential habitats in New Mexico, and will postpone the recovery process here. In addition, we did not receive a copy of the schedule of priorities, responsibilities and costs. This is one of the most important parts of the plan, and it is critical that we have an opportunity to review this.

We are anxious to participate in the recovery effort for the Gila topminnow in New Mexico, and we hope that you reconsider the plan in light of our comments. If you or members of your staff have any questions about our comments, please contact Michael Hatch at 827-9907.

Thank you for the opportunity to comment on this plan.

Sincerely,

Harold F. Olson
 Harold F. Olson
 Director

fm
Att.

REC'D
 FWS-Region 2

APR 25 1983



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
ARIZONA STATE OFFICE
2400 VALLEY BANK CENTER
PHOENIX, ARIZONA 85073

Routing slip table with names: JOHNSON, Howman, Carley, ... and a 'FILE' box at the bottom.

IN REPLY REFER TO

6840 (932)

May 2, 1983

- RD
DRD
1. AFF F
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2 ACTION SE
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CL(SE)-5-8

Memorandum

To: Assistant Regional Director (AFF), FWS, Region II
Albuquerque, New Mexico
From: Deputy State Director, Lands and Renewable Resources,
Arizona
Subject: Agency Comments: Gila and Yaqui Topminnow Recovery Plan

We have circulated your agency review draft of the subject plan among our field offices. Response has been very positive. We only have two comments of any substance.

- C.1 1. The funding of monitoring efforts as detailed on p. 17 should not be borne by the land management agencies.
C.2 2. We suggest an addition to the recovery action plan section which states "a number of waters on public lands in the BLM Phoenix and Safford Districts have been identified as possible release sites under the experimental population concept".

Thank you for the opportunity to comment. A status report on implementation of the experimental population concept would be helpful and appreciated. We are especially interested in procedures.

Handwritten signature: Hanselacher

FWS REG 2 RECEIVED

REC'D FWS-Region 2

MAY 3 - 1983

MAY 05 '83

AFF



United States Department of the Interior

BUREAU OF LAND MANAGEMENT
NEW MEXICO STATE OFFICE
P.O. BOX 1449
SANTA FE, NEW MEXICO 87501

End. Sp. R-2
<input checked="" type="checkbox"/> JOHNSON
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APR 14 1983

 2. ACTION SE

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Mr. Conard Fjetland
 Assistant Regional
 Director (AFF)
 U.S. Fish and Wildlife
 Service
 P.O. Box 1306
 Albuquerque, NM 87103:

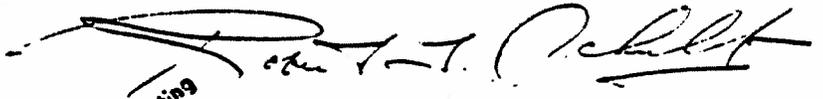
Dear Mr. Fjetland:

The draft recovery plan for Gila and Yaqui topminnow was reviewed as requested and no changes are necessary.

Please provide us with copies of the final recovery plan when they become available.

Thank you for the opportunity in allowing us to review this plan and let us know if we can be of further assistance.

Sincerely yours,


 Acting Chief, Division of Resources

REC'D
 FWS REG 2
 APR 1983
 FWS REG 2
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 APR 21 '83

SE



United States Department of the Interior

BUREAU OF RECLAMATION
LOWER COLORADO REGIONAL OFFICE
P.O. BOX 427
BOULDER CITY, NEVADA 89005

APR 28 1983

✓	ROBINSON	RD	
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REPLY REFER TO: LC-154A
565.

Memorandum

To: Assistant Regional Director (AFF), Fish and Wildlife Service,
P.O. Box 1306, Albuquerque, New Mexico 87103

From: ~~ACTUA~~ Regional Director

Subject: Review Draft Recovery Plan for Gila and Yaqui Topminnow,
(Poeciliopsis occidentalis Baird and Gerard)(your letter dated
March 24, 1983)

The subject biological portions of the report are excellent, but discussions on administrative, agency participation, and funding problems are inadequate. We suggest that the following topics be addressed:

- D.1 1. It is not mentioned if a recovery team exists.
- D.2 2. A more detailed outline discussing possible agency participation (in its area of expertise) would be extremely helpful. Also, a time table would allow agencies to coordinate, plan, and schedule their input.
- 3. Funding options should be discussed. Will all the funding come from Fish and Wildlife Service (FWS) or will it be a joint funding?

We noted no other deficiencies or errors significant enough to comment on.

REC'D
FWS-Region 2

MAY 2 1983

FWS REG 2
RECEIVED

MAY 04 '83

AFF

Michael Spear

2

E.7 7. The elevations for Rio Yaqui populations 13, 14, 15, 16, and 17 in table 1 are in error.

We are very encouraged with the Gila topminnow program and would welcome the opportunity to discuss these comments with you and your staff. We appreciate the opportunity to comment on the plan.

Sincerely,


JAMES C. OVERBAY
Deputy Regional Forester



United States
Department of
Agriculture

Forest
Service

Rocky Mountain
Forest & Range
Experiment Station

Forestry Science
Lab., ASU Campus
Tempe, AZ 85287
(602) 261-4365

END. SP. 1072	
Coordinator	
Mgmt.	
Sec. 7	
Admin.	
ACTION	
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Reply to: 4210

Date: October 22, 1982

Jerry Stagman
Acting Regional Director
U.S. Fish & Wildlife Service
P. O. Box 1306
Albuquerque, N.M. 87103

[Handwritten signature and initials]

Dear Jerry:

F.1

I have gone over the technical draft of the Gila-Yaqui topminnow recovery plan and find it well written, comprehensive, and if implemented should lead to the delisting of this now endangered fish. I think it is important to do both "subspecies" in one package. One criticism, the elevations might be changed to meters and distances from miles to kilometers.

In light of the fact that recovery is well underway (#3 in stepdown plan) it is important that guidelines be set down for monitoring these introduction sites and more importantly that the monitoring be instituted. If we can not recover this species, we will be hard pressed to accomplish recovery with other endangered and threatened species of fish.

Thanks for the opportunity to review and comment.

Sincerely,

[Handwritten signature of John N. Rinne]
JOHN N. RINNE
Fishery Biologist

Enclosure

OCT 25 1982

FWS REG 1
RECEIVED

OCT 24 1982



Dr. James E. Johnson

-2-

October 20, 1982

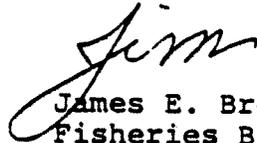
national forests as long as the U.S. Fish and Wildlife Service did not preempt other uses of the water.

In light of the MOU, I seriously doubt the concurrence of the U.S. Forest Service with protection of any natural population as an additional requirement for recovery of the species. After all, the Forest Service did stick its neck out in recognizing the MOU concept as a vehicle for the topminnows' recovery. We all did!

Thank you for the chance to comment. If I can be of further assistance, do not hesitate to call.

Sincerely,

Bud Bristow, Director



James E. Brooks
Fisheries Biologist
Fisheries Branch

JEB:mk

- H.7 6. There is also a misconception regarding potential renovation of sites by removal of Gambusia, as this is a near impossibility in most localities. At Bylas, the simplest habitat involved, renovation was unsuccessful. Similarly, repeated poisonings elsewhere in the U.S. (over a period of years) have failed to remove mosquitofish (Minckley, pers. comm.) and it certainly will not work in some of the larger habitats, such as Sharp Spring. Additionally, I doubt that you could get permission from the landowner, and I also believe this particular venture to be biologically unsound, as a large population of topminnows coexist with mosquitofish and should be left alone unless a definite decline is noted. In sum, the section on renovation of natural localities needs serious reconsideration - at the present time, it is naive.
- H.8 7. Field monitoring of introduced populations should be vigorous. There is the potential here, from stocking efforts, to gain a tremendous amount of information on the biology of this species, particularly in the area of population growth in different environments. Carefully-controlled field data collections will provide not only basic information for this species, but can also be used in general ecological contexts and thus be brought to the attention of more than just a few endangered fishes biologists. The area of monitoring, I feel, should receive high priority and be soundly and rigorously conducted.

In this context, I believe that the Sonoran topminnow, and its recovery plan, will serve as a model for future recovery efforts with other species. Certainly, more is known about this fish, and it should be easier to delist, than any other species. As such, efforts put into this recovery program will go a long way toward other endangered species programs, both biologically and politically. Thus, strong efforts in monitoring, and production of solid ecological data, will demonstrate the capabilities and potential scientific benefits of such programs.

Overall, I believe that the enclosed document is a good start toward a recovery plan, but each point outlined here and in the draft should be addressed. I feel that clarification of these points will produce a more solid recovery plan.

Thank you for the opportunity to express my opinions in this matter. Please do not hesitate to contact me, should you desire any further information.

Sincerely,


Gary K. Meffe
Ph.D. Candidate
Zoology

GKM:nm
Encl.

BRUCE BABBITT, Governor

FRANK FERGUSON, JR. Yuma, Chairman
JAMES W. WERNER, Tucson
MRS. A. JENNINGS, Scottsdale
W. J. GIBI, Flagstaff
D. S. BAKER, Elgin



ARIZONA GAME & FISH DEPARTMENT

2222 West Greenway Road Phoenix, Arizona 85021

End. Sp. R-2
JOHNSON
Bowman
Carley
Holverson
Hoffman
Kolozinski
Lungowski
Hopp
SANCHEZ

September 14, 1983
 FILE 14
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City Director
LEH J. GRUENEWALD

Regional Director
U. S. Fish and Wildlife Service
P. O. Box-1306
Albuquerque, New Mexico 87103

Dear Sir:

The Gila and Yaqui Topminnow Draft Recovery Plan has been revised by our staff and was found to be well written and technically accurate.

However, the criteria established for downlisting of the Gila topminnow are still of concern to us. On page fourteen, criterion 1a recommends that securement from non-native fish invasion and protection of habitat be accomplished. We suggest that due to the potentially difficult task of protecting topminnow habitat on private lands and in light of the Memorandum of Understanding (MOU) for reintroductions on USFS lands, criterion 1a should read as is but delete "...and through protection of the habitat by management plans, cooperative agreements, land acquisition, or other means".

Criterion 2a, while not in agreement with the MOU, should remain unchanged. It is necessary to protect existing natural populations in order to maintain genetic integrity of the species. Thus, delisting should include an assurance that natural populations will be protected.

In the implementation schedule, the Arizona Game and Fish Department is listed as one of the agencies responsible for removal of Gambusia affinis from Bylas Spring and Salt Creek. Both of these sites are on the San Carlos Apache Indian Reservation, where we have no management jurisdiction. The responsible agency other than USFWS, Region 6 should be listed as the Bureau of Indian Affairs and/or the San Carlos Apache Tribe. The Arizona Game and Fish Department should, however, be listed in column 9 as an interested agency.

Thank you for the opportunity to comment on this draft recovery plan. We trust our comments will be of assistance in finalization of this document.

Sincerely,

Bud Bristow
Bud Bristow
Director

BB:TBJ:rag

cc: Regional Director
USFS
Albuquerque, New Mexico

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Both species have survived major winter and summer flooding. Limited physicochemical data is available. The following information was developed from a single grab sample on 2 July 1983, 1105h by W. G. Kepner (BLM) and P. C. Glinski (AGFD).

Water temp.	23.9° C
pH	7.7
DO (mg/l)	8.5
EC (umho/cm)	675
Orthophosphate (mg/l)	0
Nitrate-nitrogen (mg/l)	0.2
Sulfate (mg/l)	34
Hardness (mg/l as CaCO ₃)	352
Total Alkalinity (mg/l as CaCO ₃)	280
Mean depth	0.15 m
Mean velocity	0.24 f/s
Total discharge	0.14 cfs
Sample appearance	clear
Substrate type	sand/rubble
Riparian community type	Goodding willow/mesquite

K.2 5(6). The Cocio Wash population was once threatened by overutilization by livestock and introduced green sunfish. The actual elimination of that population resulted from two back-to-back mine spills from the ASARCO Silverbell Copper Mine, not flooding. Topminnow populations are generally considered compatible with periodic flooding (see pg. 9(1) of TDRP).

K.3 11(3) and 31. Collins et al. should not be cited as in press. Impact of flooding in a Sonoran Desert stream, including elimination of an endangered fish population (Poeciliopsis o. occidentalis, Poeciliidae) was published by J. P. Collins, C. Young, J. Howell, and W. L. Minckley in 1981 (The Southwestern Naturalist 26(4):415-423).

K.4 12(1), 6b(11), and 26(3.14). Boyce Thompson Arboretum was discovered to be contaminated with mosquitofish (Gambusia affinis) by W. G. Kepner and J. E. Brooks (AGFD) on 21 July 1983. No fish stockings from the arboretum should be considered until mosquitofish have been fully removed.

K.5 19(1.0). Reference to the 10 existing topminnow habitats versus the 9 topminnow localities 5(3) is confusing. Reference to natural topminnow population numbers should be changed for consistency.

24(2.0). We concur that additional undiscovered topminnow populations probably exist along the San Pedro and Gila rivers. Although little or no T/E fish inventory information is available, suitable habitat, i.e. artesian wells and springs, are known to exist along both drainages. Mutual cooperation between state (AGFD) and federal (BIA, BLM, FWS) management agencies will be necessary to complete topminnow surveys.

K.6 26(1). ($> 1m^2$) should read ($< 1m^2$).

27(3.151). Reintroduced populations should also be initially monitored in April to evaluate overwinter survival. Periodic
K.7 monitoring could later be reduced to August/September sampling to evaluate reproductive success.

27(3.17). The BLM Phoenix District has recently evaluated 30 localities for topminnow introduction as mitigation for the Cocio Wash population. More than 18 parameters (water temperature, pH, dissolved oxygen, specific conductance, orthophosphate, nitrate-
K.8 nitrogen, sulfate, hardness, total alkalinity, substrate type, bank type, mean depth, mean velocity, total discharge, elevation, periphyton, macrophytes, and riparian community type) were measured at each locality for purposes of site evaluation, selection, and multi-variate statistical modeling. We recommend using similar criteria in the Topminnow Habitat Profile to determine topminnow habitat requirements, develop continuity in monitoring, and standardize introduction site evaluation/selection.

30(7.3). A pamphlet should be prepared providing information on the topminnow, its biology, recovery efforts, and interaction with
K.9 mosquitofish for use by state and federal public health services that utilize Gambusia for mosquito abatement.

30(7.8). We recommend petitioning the Arizona Game and Fish Department to remove mosquitofish (Gambusia affinis) as a legal baitfish in the state of Arizona. Gambusia predation has resulted
K.10 in decline and local extinction of topminnow in several documented localities. Removal of Gambusia from the legal state baitfish category may alleviate indiscriminate transplanting of mosquitofish via bait transfers.

36(02). BLM has minimal law enforcement capabilities and generally
K.11 is not construed as an enforcement agency. Therefore, we recommend removing BLM from Other Responsible Agency under this category.

Marlyn V. Jones



United States Department of the Interior

BUREAU OF RECLAMATION
LOWER COLORADO REGIONAL OFFICE
P.O. BOX 427
BOULDER CITY, NEVADA 89005

IN REPLY
REFER TO: LC-154A
120.1

SEP 16 1983

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Memorandum

To: Regional Director, Fish and Wildlife Service, P.O. Box 1306, Albuquerque, New Mexico 87103

From: **ACTING** Regional Director

Subject: Gila and Yaqui Topminnow Draft Recovery Plan (your office memorandum dated August 30, 1983)

We have reviewed the subject document and find no conflict with Bureau of Reclamation activities. The document is adequate for the purpose intended and we found no deficiencies or errors significant enough to comment on.

Robert A. B. Cullough

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SEP 21 1983

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FWS-Region 2

SEP 21 1983

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 517 Cold Avenue SW
 Albuquerque, NM 87102

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Mr. Michael J. Spear, Regional Director
U.S. Fish and Wildlife Service
P.O. Box 1306
Albuquerque, New Mexico 87103

Dear Mr. Spear:

We have reviewed your draft Recovery Plan for the Gila and Yaqui Topminnow and have the following comments.

L.1 We feel there still may be possibilities to reintroduce Yaqui topminnow within the Yaqui watershed on the Coronado National Forest and perhaps other sites outside the San Bernardino Refuge. This needs to be addressed under Item 3.1 on page 17.

L.2 We believe that protecting the genetic diversity of the species could be enhanced by stocking additional sites with other genetic sources and/or introduction of stock from other sources into reestablished sites. If genetic diversity is a major concern, we suggest that the question of genetic diversity in the natural populations be addressed as a study under Item 5.0 on page 17.

L.3 We are disturbed that the goals and objectives for downlisting and delisting have been modified from the Memorandum of Understanding (MOU). We agree with and support the concept that the natural populations represent an important component of recovery and should receive priority in management. However, because of the ownership status, the ability to protect and manage these may never exist. Therefore, recovery should not hinge on this point. If the natural populations are lost, does this mean that the species could never be downlisted or delisted? We feel the recovery goal itself needs to be re-examined and a realistic time frame established for securing the remnant populations in Item 1.0 on page 15.

If the natural populations cannot be secured in a reasonable amount of time (5-10 years), then delisting criteria should be based solely on the survivability of the reestablished populations.

Notwithstanding the above, we urge that the U.S. Fish and Wildlife Service continue to attempt to secure and protect the natural populations on private lands. The Forest Service will work with you to secure those natural populations on National Forest System lands.

The Forest Service has a strong commitment to assist in full recovery of these species where opportunities exist. The stocking of over 100 sites on National Forest System lands in the past 2 years demonstrates this commitment



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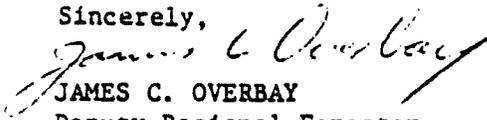
Michael J. Spear

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to recover the Gila topminnow. We would hate to see this enthusiasm blunted by the imposition of unrealistic or unachievable objectives.

We appreciate your consideration of these comments in preparing the final recovery plan.

Sincerely,



JAMES C. OVERBAY
Deputy Regional Forester



United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR
FISH AND WILDLIFE SERVICE

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In Reply Refer To:
FWS/OES

SEP 11 1983

Memorandum

To: Regional Director, Region 2 (ARD/AFF)
From: Director
Subject: Gila and Yaqui Topminnow Recovery Plan - Agency Review Draft

We have completed our review of the subject plan. On August 30, 1983, you submitted a revised agency review draft. Since our comments on the earlier draft still pertain, the earlier draft is attached (Attachment 1). Additional comments on the revised draft will be found in Attachment 2. The Region should be commended on producing an excellent plan.

- M.1 Most comments may be found in the margins of the attached text. The Region should note that the relationship and importance of the Mexican populations of both species should be addressed, as their status in Mexico will relate to their eventual delisting. The Region should also understand that "attempting" to protect natural populations does not qualify as acceptable downlisting criteria.
- M.2
- M.3 Downlisting criteria will be based on protection accomplished, not protection attempted.

We are hopeful these comments will assist you in preparation of the final plan. If you feel that any of these comments do not warrant revision of this draft, please respond in writing. Upon Regional Director's approval, please provide us with a copy of the signature page. Also, please return 25 copies of the printed plan when it is available.

Attachments

James R. Fritling
I. R. Fritling

REC'D
FWS-Region 2

SEP 12 1983

AFF

REPLIES TO COMMENTS

- A.1 Added
- A.2 Corrected
- A.3 The preferred time for transplanting topminnow populations varies with elevation, and lower elevation sites may need to be stocked slightly earlier than May.
- A.4 Recommendation incorporated into plan.
- A.5 Recommendation incorporated into plan.
- A.6 Appropriate changes made.
- B.1 Appropriate changes made.
- B.2 New Mexico historically contained only a small and peripheral portion of the range of the Gila topminnow. The criteria recommended in the plan for selection and prioritization of topminnow reintroduction sites were developed using the best biological information available and are essentially the same as those developed separately for the joint Arizona Game and Fish Department/U.S. Forest Service/U.S. Fish and Wildlife Service Gila topminnow transplant program. The placing of sites which presently contain exotic fishes into a lower priority category was not intended to discriminate against sites in New Mexico, but was simply a biologically sound decision, particularly considering the low success rate in the past for removal of exotic fishes. The criteria were developed to assure that the sites with the highest probability of success and requiring the least expenditure of time and money were given first consideration, with other sites receiving lesser consideration. These priorities are intended to give the species and the transplant program their best chance at success. Recovery objectives apply throughout the historic range of the species; however, it is true that Arizona, as the largest and only remaining portion of the range, receives greater consideration. The species can be fully recovered entirely in Arizona. Topminnow reestablishment in New Mexico is desirable, but is not essential to the species' recovery.
- B.3 The Implementation Schedule (Part III of the plan) was sent out for review during the second review of the Agency Draft of this plan.
- C.1 The statement in question was removed.
- C.2 Added

- D.1 No recovery team exists for Gila and Yaqui topminnow. A statement to that effect was added to the plan.
- D.2 See response to B.3.
- E.1 Recommendation incorporated into plan.
- E.2 Yes, newly discovered populations count toward recovery. This recommendation was incorporated into the plan.
- E.3 See response to B.2.
- E.4 The down and delisting criteria were changed to be more specific. On privately owned historic habitats conservation of the habitat is at the discretion of the landowner; on State controlled habitats the State game and fish agency is unusually responsible; and on Federal lands the responsible land management agency is required by law to promote the conservation of endangered or threatened species on all lands which they administer.
- E.5 Recommendation incorporated into plan.
- E.6 Recommendation incorporated into plan.
- E.7 Corrected
- F.1 It was felt that miles and feet better fit in with other documents on topminnow recovery.
- G.1 Added.
- G.2 The Memorandum of Understanding between the Arizona Game and Fish Department, the U.S. Forest Service, and the U.S. Fish and Wildlife Service sets up downlisting and delisting criteria based on reintroductions of topminnow onto Forest Service lands, with the specification that this MOU "...does not pertain to management of remnant wild populations of Gila topminnows presently surviving on NFS land..." and that the criteria "...assume no changes in these wild populations." However, because of the difficulty of securing topminnow populations on privately owned lands; the delisting criteria were changed to place a time limit on the attempted protection of those natural populations. Five years after the first reintroductions under that MOU (1982), any natural populations not yet secured will be eliminated from consideration in delisting.

- H.1 Appropriate changes were made.
- H.2 The species is shown on the U.S. Fish and Wildlife Services' list of Endangered and Threatened Wildlife and Plants as Gila topminnow.
- H.3 Corrected
- H.4 Information incorporated into plan.
- H.5 Recommendation incorporated into plan.
- H.6 Information incorporated into plan.
- H.7 Past attempts to remove Gambusia affinis by use of poisoning have generally been unsuccessful. However, since removal of Gambusia is of paramount importance to topminnow survival, we feel that new techniques, including use of toxicants and other methods, plus careful attention to details has the potential for success in at least some of the habitats. We agree that Sharp Spring is a large complex habitat and removal of Gambusia there is probably neither necessary or feasible. Such correction was made in the plan.
- H.8 The monitoring of reintroduced populations recommended in the plan is the minimal effort acceptable. Any opportunity to expand this monitoring should be utilized.
- I.1 Because of the existing MOU for reintroduction onto USFS lands, the protection of the existing natural population has been entirely deleted from the criteria for downlisting.
- I.2 Because of the MOU and because of USFS objections to using protection of the existing natural populations as a requirement for downlisting, the criteria for downlisting were changed as explained previously in G.2.
- I.3 Appropriate changes made.
- J.1 Previous New Mexico Department of Game and Fish comments and the responses to those comments are located at B.1, 2, and 3. Of the editorial comments referred to in B.1, 48 out of 92 comments were incorporated in the draft which this letter reviews. The 44 remaining comments were not incorporated for the following reasons: 25 style, wording and organizational changes which were felt to be unnecessary or to reduce readability; 2 comments which mistakenly requested a change in the spelling of Arivaca Creek to Aravaipa; 6 comments which conflicted with comments of other agencies; 6 comments which requested changes in content with which the Service did not agree; 2 comments which were not incorporated for reasons set forth in B.2; 1 comment which recommended establishment of a topminnow population outside of historic range (Rio

Grande Zoo); and 2 comments which recommended participation of the New Mexico Department of Game and Fish in managing existing natural populations, all of which are located in Arizona.

- J.2 These additional comments are essentially the same as the unincorporated comments mentioned in response J.1. Eleven of these 45 comments were further incorporated into the final draft.
- K.1 Added.
- K.2 Corrected.
- K.3 Appropriate changes made.
- K.4 Information incorporated into plan.
- K.5 Recommendation incorporated into plan.
- K.6 Corrected.
- K.7 Because of the wide fluctuation in topminnow numbers in the spring, it is felt that population surveys in april would provide misleading data.
- K.8 Criteria for the Topminnow Habitat Profile will be developed as part of the recovery actions.
- K.9 This pamphlet is already recommended in item 7.4
- K.10 Recommendation incorporated into plan.
- K.11 Because BLM lands, regulations, and policies are pertinent to several topminnow recovery items, it was felt that BLM has direct or indirect responsibility in proper law enforcement.
- L.1 Recommendation incorporated into plan.
- L.2 Genetic diversity maintenance in the stocks at Dexter NFH is already addressed in item 3.0. Work on topminnow genetics is presently conducted by Robert Urijenhoek at Rutgers University.
- L.3 Recommendation incorporated into plan (see response I.2).
- M.1 Appropriate changes made.
- M.2 It is unlikely that any of the Gila subspecies is still remaining in New Mexico. The Yaqui subspecies is still widespread and abundant in Mexico. Both of these items are addressed in the introductory portion of the plan. The Mexican populations of the Yaqui subspecies

are not being considered in the criteria for down- and delisting because of their total lack of protection, the rapidity with which they can be eliminated, the difficulty in monitoring their status, and the recent introduction of Gambusia affinis into the Rio Yaqui system.

M.3 Recommendation incorporated into plan.