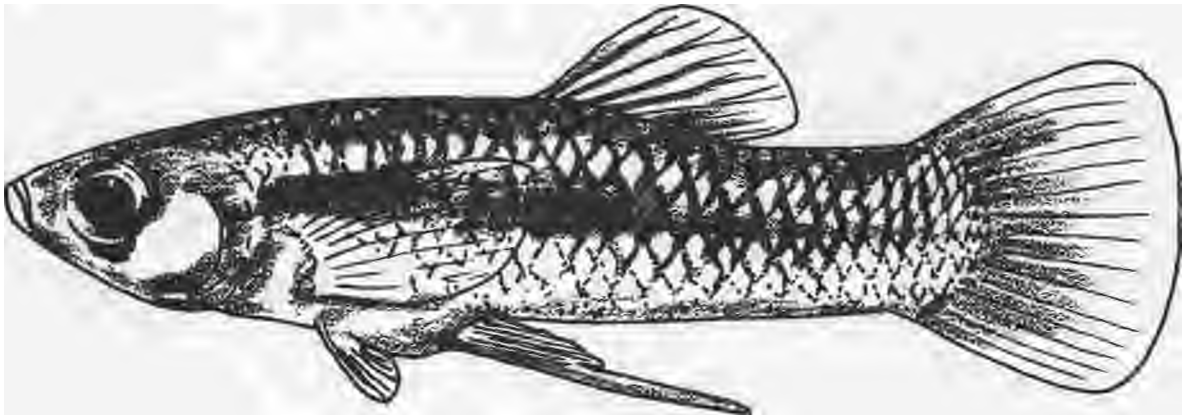
PECOS GAMBUSIA RECOVERY PLAN



C. QUILL

U.S. FISH AND WILDLIFE SERVICE

ALBUQUERQUE, NEW MEXICO

1983

RECOVERY PLAN

FOR

PECOS GAMBUSIA (GAMBUSIA NOBILIS)

PREPARED BY THE

RIO GRANDE FISHES RECOVERY TEAM

November 16, 1981

TEAM MEMBERS

Clark Hubbs, Team Leader, University of Texas
Salvador Contreras-Balderas, University of Nuevo Leon
Anthony A. Echelle, Oklahoma State University
Michael D. Hatch, New Mexico Department of Game and Fish
Buddy L. Jensen, U.S. Fish and Wildlife Service
Floyd E. Potter, Jr., Texas Parks and Wildlife Department

TEAM CONSULTANTS

Gerard Hoddenbach, National Park Service
William McPherson, U.S. Soil Conservation Service

APPROVED:

Regional Director, Region 2
U.S. Fish and Wildlife Service

- 1923
Date

SUMMARY

1. The ultimate goal of the recovery plan is to improve the status of the Pecos gambusia (Gambusia nobilis) to the point that survival is secured and the species can be downlisted. This goal should result from implementation of the recovery plan.

2. The objective of the Pecos Gambusia Recovery Plan is to improve the status of the Pecos gambusia to the point that survival of the populations from the four major areas of occurrence is secured.

3. When monitoring of Pecos gambusia populations and habitats as described in Section 1.0 of the Stepdown Narrative (p. 22) indicate the four major populations are stable and secure, the species will be reclassified to Threatened.

4. When reintroduction efforts described in Section 2.0 (p. 24) are accomplished, the species will be removed from the Federal list of Threatened and Endangered species.

TABLE OF CONTENTS

Preface ii

List of Figures iii

List of Tables iii

Introduction (Part I)

Phylogeny and Nomenclature 1
Taxonomy 1
Distribution
Historical Distribution 1
Present Distribution in New Mexico 4
Present Distribution in Texas 4
Abundance 10
Reasons for Decline ... 10
Loss of Habitat ... 11
Introduction of Nonnative (Exogenous) Fishes ... 11
Ecological Factors Affecting Abundance and Distribution ... 11
Salinity 11
Habitat Structure ... 12
Temperature 12
Predation 13
Foods 13
Habitat Stability and Competition ... 13
Hybridization 14
Fecundity and Reproduction ... 14
Species Associations ... 15
Conservation Efforts and Protective Measures ... 15

Literature Cited ... 18

The Action Plan (Part II)

Objectives 20

Recovery Plan Stepdown Outline ... 20

Narrative 22

Implementation Schedule (Part III) ... 28

Responses and Comments (Part IV) ... 31

Appendix A 41

PREFACE

The Pecos Gambusia Recovery Plan was developed by the Rio Grande Fishes Recovery Team, an independent group of biologists sponsored by the Albuquerque Regional Director of the U.S. Fish and Wildlife Service.

The recovery plan is based upon the belief that State and Federal conservation agencies and knowledgeable, interested individuals should endeavor to preserve the Pecos gambusia and its habitat and to restore them, as much as possible, to their historic status. The objective of the plan is to make this belief a reality.

The recovery team has used the best information available to them as well as their collective knowledge and experience in producing this recovery plan. It is hoped the plan will be utilized by all agencies, institutions, and individuals concerned with the Pecos gambusia to coordinate conservation activities. Periodically, and as the plan is implemented, revisions will be necessary. Revisions will be the responsibility of the recovery team and implementation is the task of the managing agencies.

This completed Pecos Gambusia Recovery Plan has been approved by the U.S. Fish and Wildlife Service. The plan does not necessarily represent official positions or approvals of cooperating agencies and does not necessarily represent the views of all recovery team members. This plan is subject to modification as dictated by new findings and changes in species status and completion of tasks assigned 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. 1982. Pecos Gambusia (Gambusia nobilis) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. iii + 41 pp.

LIST OF FIGURES

Number		Page
1.	Gonopodial tips of Gambusia nobilis, Gambusia affinis, and Gambusia geiseri	2
2.	Past, present, and introduced populations of Gambusia nobilis	5
3.	Map of portion of Bitter Lake National Wildlife Refuge	6
4.	Blue Spring and surrounding area	7
5.	Springs and associated canals around Balmorhea, Texas	
6.	Leon Creek and Diamond-Y Spring drainage map	9

LIST OF TABLES

Number		
1.	Distinguishing gonopodial characters for Gambusia nobilis, Gambusia affinis, and Gambusia geiseri	2
2.	Distinguishing color and morphometric characters for Gambusia nobilis, Gambusia affinis, and Gambusia geiseri	3
3.	Fishes found coexisting with G. nobilis at the five general areas of occurrence	16

PART I INTRODUCTION

The Pecos gambusia (Gambusia nobilis) was designated an endangered species, as defined in Section 4 of the Endangered Species Act of 1973, in the "Federal Register" on October 13, 1970 (FR 35:16047:16048). The species also is designated an endangered species by the States of New Mexico and Texas and by the American Fisheries Society.

Phylogeny and Nomenclature

The Pecos gambusia, G. nobilis (Atheriniformes, Poeciliidae), was first described as Heterandria nobilis by Baird and Girard in 1853 based on a syntypic series of specimens collected in 1853 from Leon and Comanche Springs, Pecos County, Texas, but later was assigned to the genus Gambusia by Girard (1859). Regan (1913) synonymized G. nobilis and G. senilis, but beginning with Hubbs (1926), both have been recognized as distinct and valid species. A female specimen from Leon Springs was designated the lectotype by Hubbs and Springer (1957); therefore, Leon Springs is the type locality.

Taxonomy

Gambusia nobilis is a small, livebearing member of the Poeciliidae. Poeciliids are characterized by strong sexual dimorphism. The anal fin of males is modified into a gonopodium, an intromittent organ used in copulation. Gonopodial structures distinguish G. nobilis from the other poeciliids (i.e., Gambusia affinis and Gambusia geiseri) known to occur within its native range (Fig. 1 and Table 1).

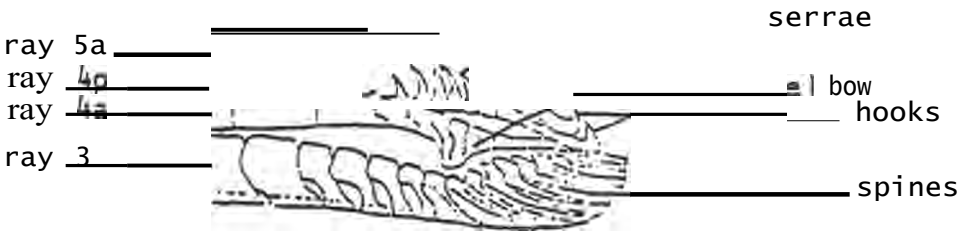
Color patterns are useful in making preliminary field identifications and morphometric characters, although environmentally plastic, aid in identification (Table 2).

Differentiation occurs among the widely separated populations of G. nobilis. Hubbs and Springer (1957) reported differentiation between the extirpated Comanche Springs population and the extant populations in western Texas. Echelle and Echelle (1980) demonstrated that the Balmorhea population is the most genetically divergent of the extant populations and may merit formal recognition at the subspecific level. This population has declined and warrants special management considerations.

Distribution

Historical Distribution

Gambusia nobilis is endemic to the Pecos River basin in southeastern New Mexico and western Texas (Hubbs and Springer 1957, Behnke 1974) The species occurred at least as far south as Fort Stockton, Texas, and



A

8

Figure Gonopodial tips of (A) Gambusia nobilis, (8) Gambusia affinis, and (C) Gambusia geiseri. Anatomical features common to all three species are indicated in.drawing A. Drawings A and B are from Rivas (1363), drawing C is from Hubbs and Springer (1957).

Gonopodial Character	Gambusia nobilis	Gambusia affinis	Gambusia geiseri
Sines of ray 3.	Elongated.	Short and thick.	Elongated; proximal spines have recurved hooks.
Hooks on rays 4p and 5a.	Small and rounded; located near terminal end of gonopodium.	Enlarged and angular; located several ray segments proximal to gonopodial tip.	Enlarged and angular; located near terminal end of gonopodium.
Elbow on ray 4a.	Located opposite the serrae of ray 40; composed of 3 or 4 fused segments.	Located distal to serrae of ray 4p; most of the segments distal to elbow coalesced along their anterior margin.	Located one segment distal to serrae of ray 4a and composed of 1 or 2 segments.

Table 1. Distinguishing gonopodial characters for Gambusia nobilis, Gambusia affinis and Gambusia geiseri.

Morphometric Character	Gambusia nobilis	Gambusia affinis	Gambusia geiseri
Profile	Back arched. Robust; caudal peduncle depth approximately 2/3 the head length.	Back relatively straight. Slender; caudal peduncle depth approximately 1/2 the head length.	Back relatively straight; slender; caudal peduncle depth approximately 1/2 the head length.
Melanophore Patterns	A. Margins of scale pockets outlined in black	A. Margins of scale pockets not outlined in black.	A. Margins of scale pockets outlined in black.
	B. Spots normally absent on caudal fin although faint medial row of spots may be present. The dorsal fin has a subbasal row of spots.	B. Several rows of conspicuous spots on the caudal and dorsal fins.	B. Several rows of conspicuous spots on the caudal and dorsal fins
	C. Females have a black area on the abdomen that surrounds the anus and anal fin.	C. Females have a black area on the abdomen that is restricted to the anal area.	C. Females have a black area on the abdomen that surrounds the anus and anal fin.

Table 2. Distinguishing color and morphometric characters for Gambusia nobilis, Gambusia affinis, and Gambusia geiseri. In part from Koster (1957).

as far north as near Fort Sumner, New Mexico (Fig. 2). Recent records are restricted to springs and their outflow on the west slope of the Pecos River drainage.

Present Distribution in New Mexico

Twelve populations of G. nobilis are known to occur near Roswell, New Mexico. Natural populations occur on the Bitter Lake National Wildlife Refuge in isolated gypsum sinkholes 7 and 27, and in Sago and Dragonfly Springs, including their outflows which combine to form the perennial portion of the Lost River (Fig. 3). One additional natural population occurs on the refuge in Sinkhole 20; however, a supplemental stocking of G. nobilis was made in this sinkhole in 1973. Introduced populations occur on Bitter Lake National Wildlife Refuge in isolated gypsum sinkholes 2, 3, 10, 15, 37, and 42 and on the Salt Creek Wilderness Area in Ink Pot, an isolated gypsum sinkhole. Populations in Sinkhole 10 and in Ink Pot resulted from a 1973 stocking. Populations in Sinkholes 2, 3, 15, 37, and 42 resulted from stockings made in July and August 1980. In 1979, Echelle and Echelle (1980) collected a few specimens of G. nobilis and G. nobilis x G. affinis hybrids from Units 3 and 5 of the refuge (Fig. 3). It is not clear whether G. nobilis x G. affinis hybridization is a result of the introduction of G. nobilis into the area or whether a few G. nobilis and associated hybridization are a persistent part of the species' biology.

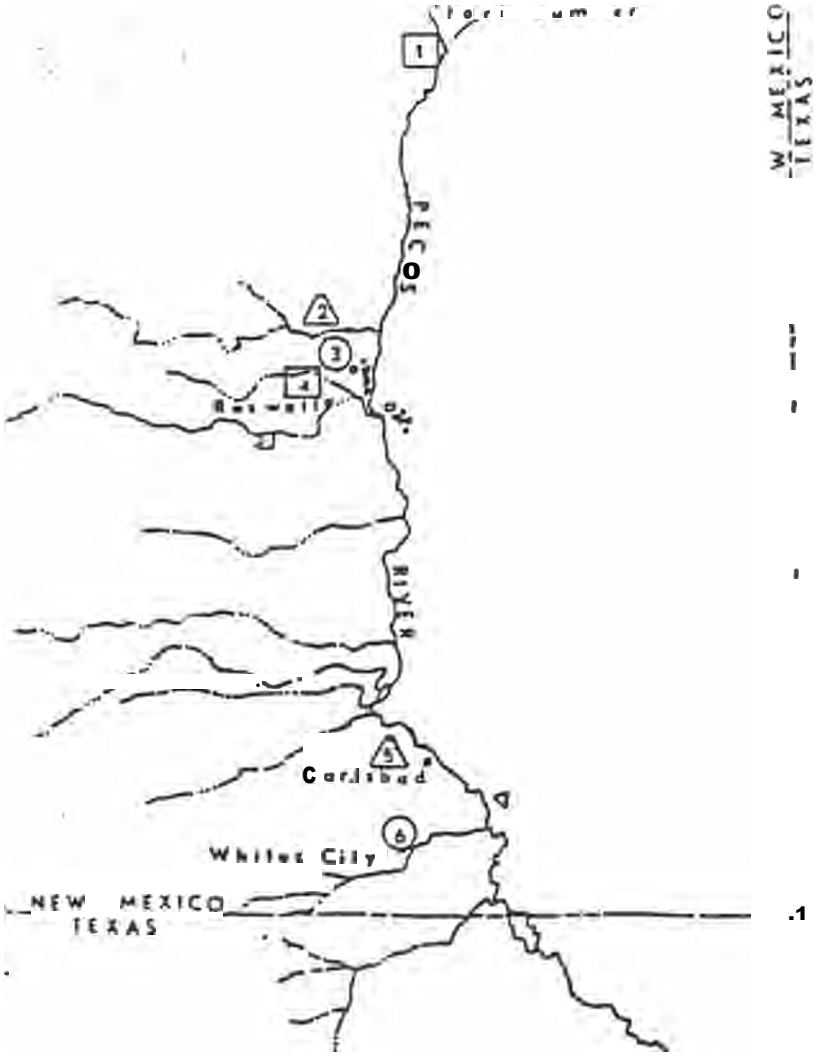
Gambusia nobilis presently occurs in Blue Spring, a 4 km spring run that flows into the Black River near Black River Village, New Mexico (Fig. 4). The species is found from the spring source to within 50 m of the waterfall (15 m high) at the confluence with Black River (Hubbs and Echelle 1972). An introduced stock of G. nobilis occurs in a series of artificial pools at the Living Desert State Park near Carlsbad, New Mexico. The original source for this population presumably came from Blue Spring in 1975.

Gambusia nobilis has been extirpated from two historic locations of occurrence in New Mexico, including the Pecos River near Fort Sumner and North Spring River near Roswell.

Present Distribution in Texas

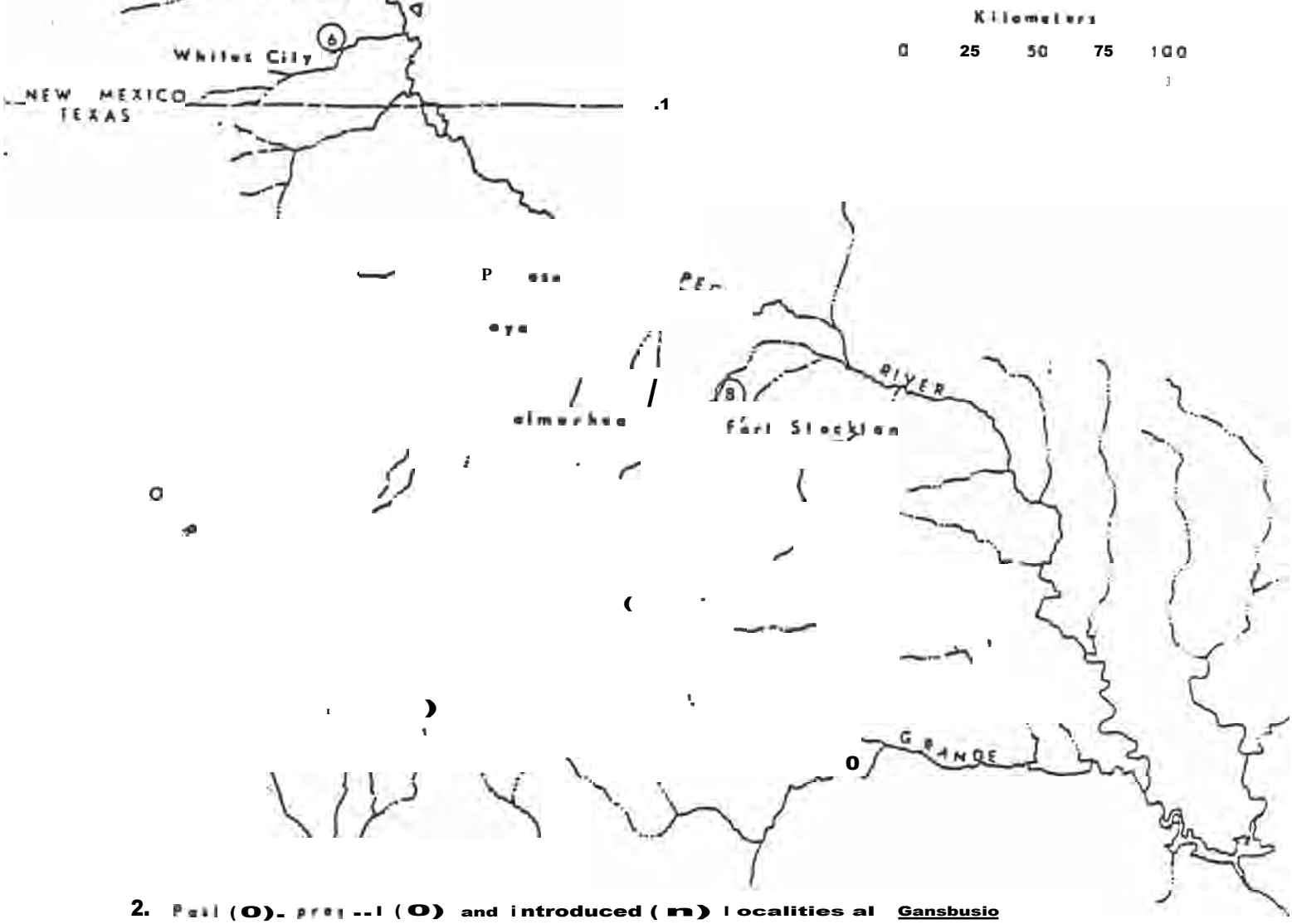
Populations of G. nobilis occur near Balmorhea, Texas, in the headwaters of Phantom Lake and in Giffin and East Sandia Springs (Fig. 5). Historically, the species inhabitated much of the canal system in this area. These populations diverge genetically from those inhabiting the other major areas (Echelle and Echelle 1980).

A substantial population of G. nobilis occurs in Leon Creek and in Diamond-Y Spring outflow north of Fort Stockton (Fig. 6). The population exists in two discrete segments normally isolated by two kilometers of dry stream bed. Although evidence of hybridization with G. affinis occurs in the downstream isolated segment of Leon Creek, pure G. nobilis can be found throughout both segments.



LEGEND

1. Pecos River, 9 mi SSE of Ft. Sumner (extirpated).
2. Ink Pot, Salt Creek Wilderness Area.
3. Bitter Lake National Wildlife Refuge including Sinkholes 2, 3, 7, 10, 20, 27, 37, and 42, and Sago and Dragonfly springs along with their outflows (i.e., the Lost River).
4. North Spring River (extirpated).
5. Living Desert State Park.
6. Blue Spring and its outflow.
7. Balmorhea area including East Sandia Spring, Phantom Lake Spring and its irrigation system, and Giffin Spring.
8. Leon Creek and Diamond-Y Spring outflow.
9. Leon Spring (extirpated).
10. Comanche Springs (extirpated).



2. Past (O)- pres--t (O) and introduced (■) localities al Gansbusio

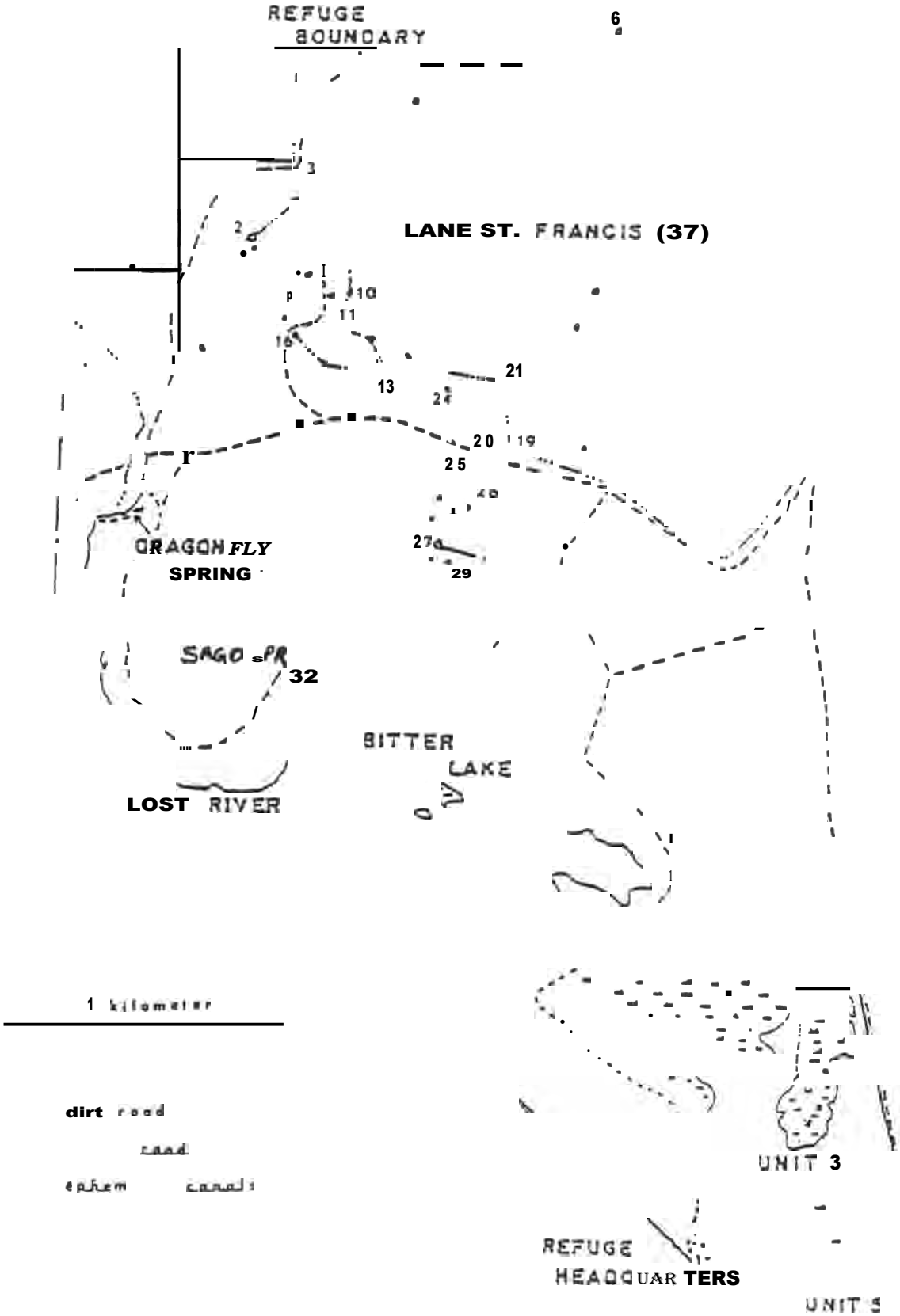


Figure 3. Map portion of Bitter Lake National Wildlife Refuge. Areas occupied by G. nobilis include sinkholes 2, 3, 7, 10, 15, 20, 27, 37, and 42, and Sago and Dragonfly Springs and their outflow. Modified from Bednarz (1979).

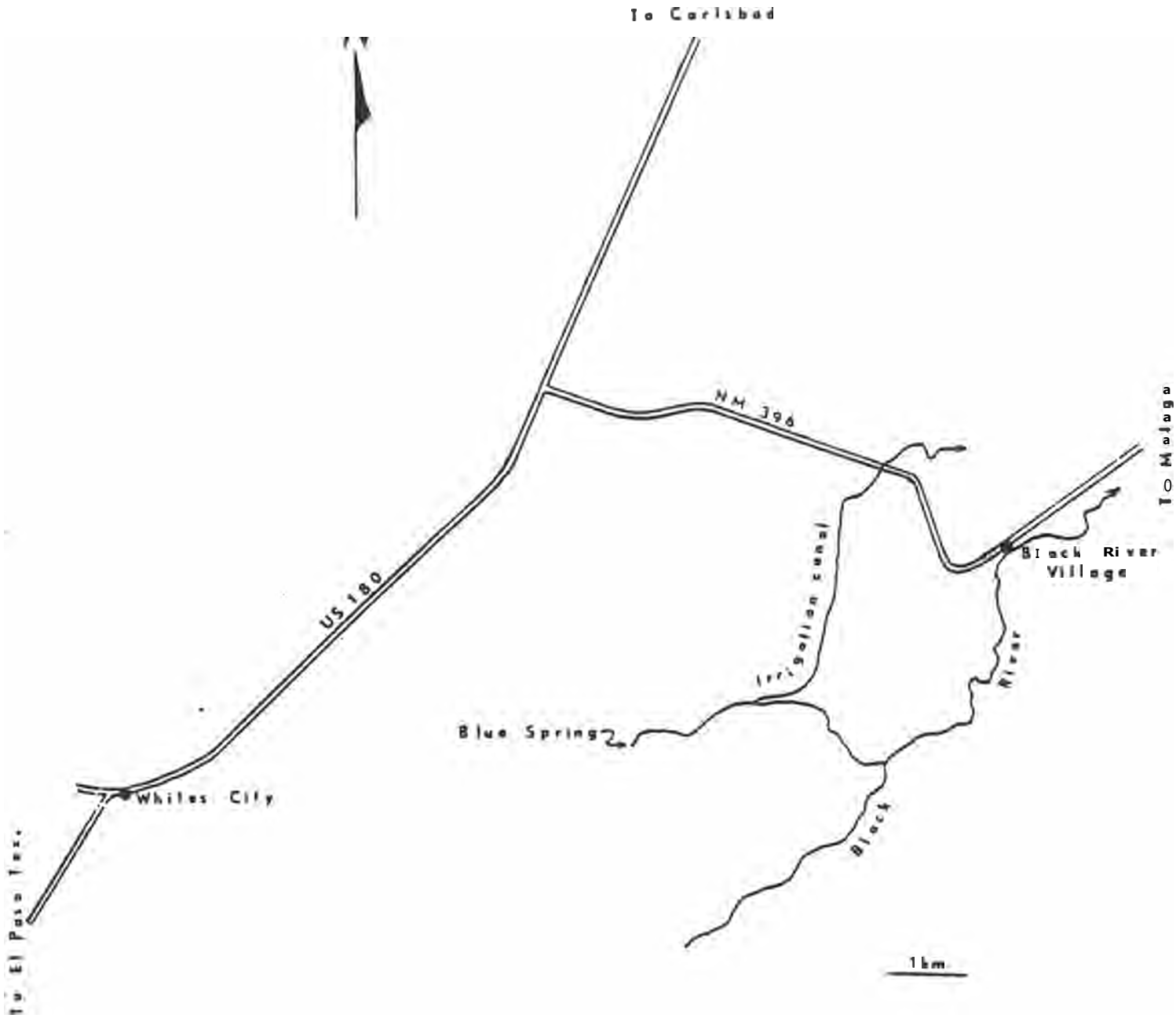


Figure 4. Blue Spring and s..... unding area.

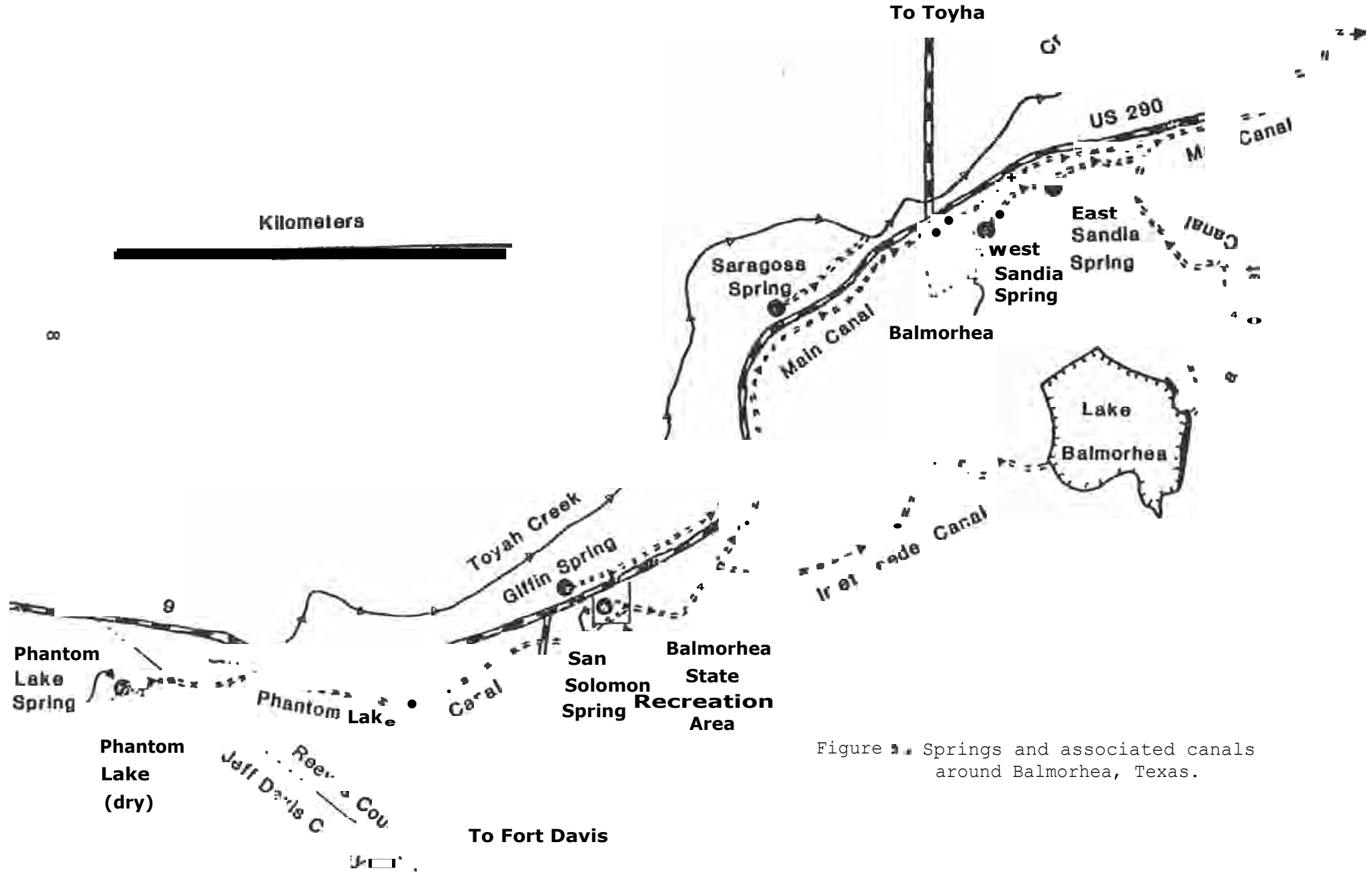


Figure 5. Springs and associated canals around Balmorhea, Texas.

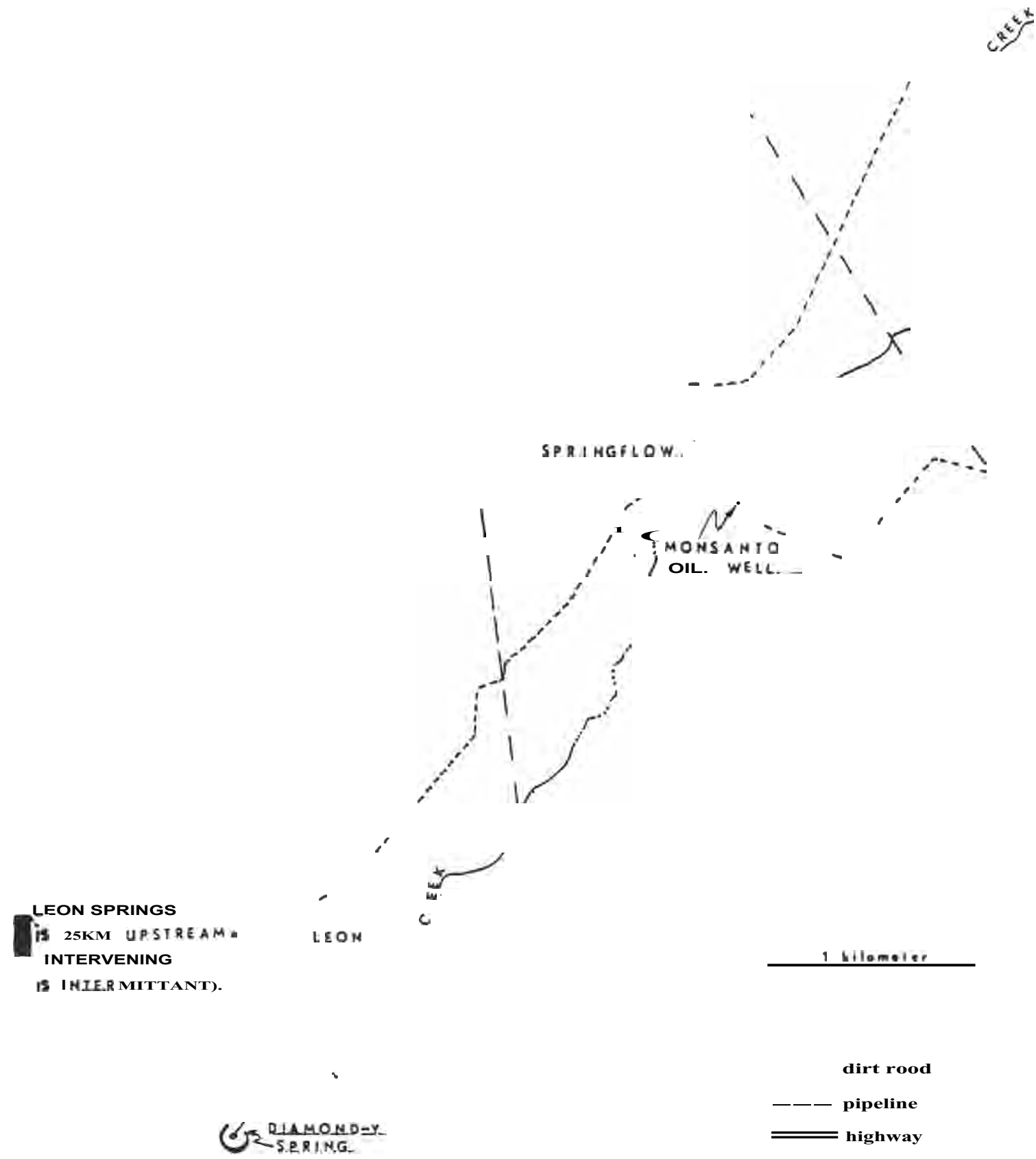


Figure 6. Leon Creek and Diamond—Y Spring drainage map. Modified from Echelle and Echelle (1980).

Two additional populations once occurred in the vicinity of Leon Creek. The type locality is Leon Springs, about 16 kilometers upstream from Diamond-Y Spring along the now dry Leon Creek streambed. The present Leon Creek population(s) likely is genetically similar to the population that once inhabitated the type locality. Leon Springs was examined for G. nobilis in 1938 and none were found; presumably that population had been extirpated after the spring flow failed (Hubbs 1980). A large population of G. nobilis also occurred in Comanche Springs, but none were found in 1956 when there was no spring flow (Hubbs and Springer 1957). This population was reported to differ from the Balmorhea fish (Hubbs and Springer 1957), but no comparison with the Leon Creek population has been made.

Hubbs and Echelle (1972) incorrectly listed Tunis Spring as a site that once contained G. nobilis. Likewise, Girard (1859) incorrectly listed G. nobilis from Zoquito (Hubbs and Springer 1957).

Abundance

New Mexico

Bednarz (1975, 1979) estimated that 26,550 - 28,650 adult G. nobilis occurred on Bitter Lake National Wildlife Refuge. This is the sum of the following estimates for individual locations: Sinkhole 2 (350 - 450), Sinkhole 7 (4,000 - 5,000), Sinkhole 10 (100), Sinkhole 20 (1,500 - 2,000), Sinkhole 27 (3,000 - 3,500), Sago Spring (9,000), Dragonfly Spring (3,000) and Lost River (10,700). Recent discoveries of small populations in Unit 3 and the ditch between Units 3 and 5 of the refuge, along with recently established populations in Sinkholes 3, 15, 37, and 42, should increase Bednarz' total estimate for the refuge. The population estimate for Sinkhole 2 may no longer reflect the current situation because that population was extirpated subsequent to when Bednarz made his estimate and G. nobilis was reintroduced there in 1980. Bednarz also estimated the Blue Spring population at approximately 900,000 in 1975, and Echelle and Echelle (1980) considered that a reasonable estimate. The abundance of the introduced populations at Ink Pot on the Salt Creek Wilderness Area and at the Living Desert State Park have not been determined.

Texas

More than 100,000 adult G. nobilis occur in the Balmorhea area. About 88% of this total occurs in the head pool of East Sandia Spring, 9% in the upper portion of Phantom Lake Spring irrigation system, and 3% in the headwaters of Giffin Canal. More than one million G. nobilis occur in Leon Creek, with approximately 100,000 in the Diamond-Y outflow and the marsh it feeds and the remainder in Leon Creek proper (Echelle and Echelle 1980).

Reasons for Decline

Presently, six endemic poeciliids confined to springs and their associated outflow streams in Texas, New Mexico, and Arizona, are listed as endangered. Each of these species is facing extinction because of one or both of two major threats: (1) Loss of habitat and (2) the inability to interact successfully with nonnative (exogenous) fish species, especially Gambusia. The known occurrences of G. nobilis (Fig. 2) indicate that the species once was more widespread. Gambusia nobilis has declined to the point where it now occupies only four major localities. Furthermore, the size of certain populations has declined considerably.

Loss of habitat

The Pecos River mainstream has been influenced by man for more than 100 years, first through water withdrawals for irrigation and more recently through the construction of mainstream dams for irrigation and flood control. Presently, five major dams and at least three lesser dams are on the mainstream Pecos River, and another dam (Brantley) is planned. These water uses have severely depleted natural flows in the river along major sections and caused drastic increases in salinities in the remaining reaches.

Although the mainstream Pecos River probably was never important as permanent habitat, the mainstream served as a dispersal route between tributary springs and streams. The more important lateral habitats initially were impacted by extensive ground water pumping of the aquifers surrounding the Pecos River in the mid-1900s. This caused cessation of flow and extirpation of G. nobilis from Comanche Springs and North Spring River and caused reduced flow with loss of habitat in other areas. As a result of these habitat losses, the fish became isolated in permanent springs and is totally dependent upon spring flow for their survival.

Introduction of nonnative (exogenous) fish

Many of the endangered poeciliids are confined to springfed areas because they cannot compete with fish species not native to the endangered poeciliids' habitats. The introduction of these nonnative, or exogenous, fish species and their effects on the native fish fauna have been well documented (Miller 1961, Minckley and Deacon 1968). The native fishes, which have evolved in communities with low species diversity, are often unable to compete with introduced species. The effects of competition on G. nobilis are well known and available data indicate that they are disappearing in the Balmorhea area because of the expansion of G. geiseri, a nonnative poeciliid introduced into the springs in the early 1930s. Other potential effects of the introduction of exogenous species include predation, hybridization, and introduced diseases.

Ecological Factors Affecting Abundance and Distribution

Habitat

Gambusia nobilis occurs abundantly in springheads and spring runs. Moderately abundant populations are also known from areas with little spring influence, but with abundant overhead cover, sedge covered marshes, and gypsum sinkholes (Echelle and Echelle 1980). G. nobilis has been observed to occur from the surface to depths of three meters.

Present G. nobilis habitats are seldom subjected to destructive scouring by floods. However, all G. nobilis habitats occasionally are subjected to flood waters and silt deposition. For example, in 1978 and 1979, Blue Spring received a heavy influx of silt carried by the runoff of heavy rains. This siltation problem developed after an undergound pipeline was installed near the springhead without taking follow-up precautions to contour excavations properly and reseed disturbed areas. Runoff from thunderstorms in 1978 and 1979 proved sufficient to deposit silt in Blue Spring, filling many of the holes in the spring run for a short time.

Gambusia is primarily a subtropical genus. The closest relatives of G. nobilis occur in Mexico and south Texas. For this reason, G. nobilis is known principally from the lower elevations and more thermally stable localities (i.e., springs) within its geographic range. Ink Pot, located on the Salt Creek Wilderness Area northeast of Roswell, represents the highest elevation (approx. 1080 m) and northernmost area presently known to be occupied by G. nobilis. All populations, including those at historic, present, and introduction sites, occur between 822 m and 1187 m elevation, a range in elevation of 365 m.

The narrow elevation range suggests a narrow range of temperature tolerance. Gehlbach et al. (1978) reported average critical thermal maxima of 38.1-39.3 C for G. nobilis, and thermal preferenda of 21-25 C in the morning and 26-30 C in the afternoon. In contrast, Winkler (1979) found the potential competitor G. affinis more tolerant of higher temperatures, preferring 31 C. Echelle and Echelle (1980), Bednarz (1979), and Hubbs et al. (1978) reported that G. nobilis was more abundant in stenothermal, spring-fed situations. However, in several locations they observed that G. nobilis was doing well in less spring-like waters where sufficient cover provided a cool refugium against hot temperatures. No data are available on cold tolerances of G. nobilis.

Gambusia nobilis occurs abundantly in waters with conductivities ranging from near 1200 umhos/cm at Blue Spring to 32,500 umhos/cm in Sinkhole 27 on Bitter Lake National Wildlife Refuge. These conductivity values roughly correspond to total dissolved solids concentrations of 1 and 30 ppt, respectively. Within this range, salinity apparently is not a major limiting factor, although 30 ppt must be near the upper tolerance level of the species (Echelle and Echelle 1980).

Predation

Predation on G. nobilis could be a major limiting factor in areas where no submerged vegetation or sufficiently shallow areas provide cover from predators. Predation by the centrarchids Lepomis cyanellus and/or Micropterus salmoides may have eliminated the introduced population of *G.* nobilis from Lake St. Francis on the Bitter Lake National Wildlife Refuge and also may have contributed to the failure of a population introduced into Geyser Spring, New Mexico. Also, virtual absence of G. nobilis from the head pool of Diamond-Y Spring may be attributable partly to the presence of L. cyanellus and M. salmoides. Gambusia nobilis is extremely abundant in shallow marshy areas of Leon Creek and Blue Spring, even though predators (centrarchids) are present in the deeper and more open waters.

Foods

Bednarz (1979) emphasized that G. nobilis, like other Gambusia, is a carnivorous surface feeder." He found filamentous algae, insects, and unidentifiable animal material in 20 digestive tracts. Hubbs et al. (1978) noted that G. nobilis fed on amphipods more than did other fishes in their study, but that a wide variety of food items indicated the species is an opportunistic feeder. Thus, availability of specific kinds of foods apparently does not constitute a major limiting factor.

Habitat Stability and Competition

Based on present patterns of occurrence and abundance, G. affinis seems to outcompete G. nobilis in relatively unstable habitats, such as isolated pools and downstream waters removed from spring influence. On the other hand, G. nobilis is better adapted to the relatively constant habitats of springs and spring outflows. G. nobilis and G. affinis have been in contact for thousands of years (Hubbs and Springer 1957, Echelle and Echelle 1980), but due to ecological segregation, the Pecos gambusia seems in no danger of being eliminated.

Gambusia geiseri occurs in west Texas as a result of introductions from large, freshwater (<1000 umhos/cm) springs near San Marcos, Texas (Hubbs and Springer 1957). G. geiseri was documented in Comanche Springs as early as 1937 and from the Balmorhea area by 1956. Since that time, competition with G. geiseri seems to present a greater threat than that posed by G. affinis (Echelle and Echelle 1980).

The danger to G. nobilis from competition with G. geiseri may vary depending upon the salinity of the water (Echelle and Echelle 1980). G. geiseri is widespread in the freshwater springs and peripheral waters of the Balmorhea area with conductivities of 3500-5000 umhos/cm, while in relatively saline waters of Leon Creek with conductivities near 15,000 umhos/cm,

G. geiseri occurs only in Diamond-Y Spring and its outflow. Perhaps because of salinity, G. geiseri is near its critical level of physiological tolerance in Diamond-Y Spring, and the additional stresses imposed by the less spring-like waters in other areas exceed its tolerance (Echelle and Echelle 1980). G. nobilis, on the other hand, occurs naturally at a wide range of salinities. For example, G. nobilis occurs in Sinkhole 20 on the Bitter Lake National Wildlife Refuge and in Blue Spring, with approximate conductivities of 32,500 and 1400 umhos/cm, respectively. Thus, G. nobilis seems to outcompete G. geiseri in the saline waters of Leon Creek, while G. geiseri seems competitively superior in the freshwaters of the Balmorhea area (Echelle and Echelle 1980).

Hybridization

Gambusia nobilis is known to hybridize with both G. affinis and G. geiseri; G. nobilis x G. affinis hybrids are most common. Levels of hybridization between Gambusia are affected primarily by two factors: (1) ability to discriminate against heterospecific mates, and (2) the relative abundance of the two species.

When two closely related species occur with one very abundant and the other relatively rare, hybridization is likely to occur. Although Gambusia males tend to court females of their own species more often than those of other species (Peden 1970), heterospecific courtship is not uncommon. When one species is rare and another common, the males and/or females of the rare species would have relatively infrequent encounters with conspecific individuals, while having frequent encounters with members of the common species. This should favor heterospecific matings (Hubbs 1961), especially between subordinate males of the common species and females of the rare species (Moore and McKay 1971).

Apparently, because of ecological segregation and concomitant selection for pure G. nobilis and G. affinis genomes, hybridization with G. affinis seems to pose no immediate threat to most existing populations of G. nobilis. However, the relationship between relative abundance of the two species and hybridization has obvious implications for long term management practices. Similarly, hybridization between G. geiseri and G. nobilis poses no threat for G. nobilis, because G. geiseri effectively discriminates against heterospecific mating (Hubbs and Delco 1960).

Fecundity and Reproduction

Fecundity and reproduction data for G. nobilis are known only from studies on the Blue Spring population. Bednarz (1979) found that twenty gravid G. affinis from Blue Spring contained a mean of 56 embryos, significantly different from the mean of 38 embryos in G. nobilis. This differential reproductive potential may account for the dominance of G. affinis over

X=Common Occurrence O=Occasional Occurrence	ROSWELL AREA		Blue Spring	Balmorhea Area	[illegible]
	Ink Pot, Salt Creek Wilderness Area	Bitter Lake Refuge			
Atherinidae					
Menidia beryllina				O	
Centrarchidae					
Ambloplites rupestris			X		
Lepomis cyanellus		O		O	O
Lepomis humilis				O	
Lepomis megalotis			X	O	
Micropterus salmoides					O
Characidae					
Astyanax mexicanus			X	X	
Clupeidae					
Dorosoma cepedianum		O		O	
Cyprinidae					
Cyprinus carpio		O			O
Dionda episcopa		X	X	X	
Hybognathus nuchalis				O	
Notropis lutrensis	X	X		O	O
Pimephales promelas		O		O	
Pimephales vigilax				O	
Cyprinodontidae					
Cyprinodon bovinus					X
Cyprinodon elegans				X	
Cyprinodon pecosensis	X	X			
Cyprinodon variegatus				X	
C. bovinus x C. variegatus					O
Fundulus zebrinus	X	X			X
Lucania parva		X			X
Ictaluridae					
Ictalurus melas				O	
Ictalurus punctatus				O	
Percidae					
Etheostoma lepidum		X	X		
Poeciliidae					
Gambusia affinis			X	X	X
Gambusia geiseri				X	X
Gambusia nobilis	X		X	X	X

Table 3. Fishes found coexisting with G. nobilis at the four general areas of occurrence. In part from Sublette and Crowley (1979).

G. nobilis in some habitat situations. Ecological theory predicts that in unstable habitats with high density-independent mortality, natural selection should favor species with higher reproductive rates, while stable habitats with low density-independent mortality should favor forms with more energy investment per offspring (i.e., lower reproductive rates). Thus, the lower reproductive rate of G. nobilis may be favored in stable spring-fed habitats and the higher rate of G. affinis may be favored in more unstable situations.

Species Associations

Gambusia nobilis appears to coexist well with most species of fishes found in the same habitat, except other Gambusia (Table 3). Hubbs and Echelle (1972) reported that G. affinis at Blue Spring was found primarily in still water and G. nobilis mostly where there was moving water. In contrast, Bednarz (1979) reported that G. affinis and G. nobilis were sympatric throughout the spring run and that G. nobilis was not particularly associated with the current. Echelle and Echelle (1980) summarized the available information and stated that G. affinis dominates the lower end of the springrun at Blue Spring. As one progresses up the run toward the springhead, the two species gradually assume equal numbers and G. nobilis eventually becomes dominant near the spring origin. Similar ecological segregation occurs at Leon Creek (Hubbs et al. 1978), at Bitter Lake National National Wildlife Refuge, and at Balmorhea (Echelle and Echelle 1980). Apparently G. nobilis is better able to compete with G. affinis where the aquatic habitat is influenced by the main headspring and other small spring flows and seepages in the upper end of the run.

Conservation Efforts and Protective Measures

Several management actions are possible. Some have already been implemented and others will be recommended in Part II of this plan.

During August 1972 and April and May 1973, the Bitter Lake National Wildlife Refuge in New Mexico transplanted G. nobilis from various waters near the north end of the refuge into 20 separate localities within the same refuge and within the Salt Creek Wilderness Area. As a result of these transplants, new populations were established in Sinkholes 2 and 10 and in Ink Pot, and an existing population in Sinkhole 20 was supplemented. The other 16 transplants failed. Additional transplants of G. nobilis were made within the Bitter Lake National Wildlife Refuge during July and August 1981. However, adequate time has not elapsed to determine if these represent viable stocks.

U.S. Fish and Wildlife Service personnel at Dexter National Fish Hatchery, Dexter, New Mexico, successfully raised G. nobilis in captivity. In addition, personnel from the New Mexico Department of Game and Fish, in cooperation with personnel from the New Mexico Environmental Improvement

Division, successfully raised G. nobilis in an abandoned sewer treatment facility at Carlsbad, New Mexico. These stocks have been terminated, but their success demonstrates the feasibility of this approach.

The Texas Parks and Wildlife Department constructed a native fish fauna refugium at Balmorhea State Recreation Area. Although the refugium was constructed principally for the conservation of Cyprinodon elegans, it is being considered for introduction of G. nobilis. G. nobilis is protected against human incursions at Phantom Lake Spring because the Federal land on which the spring is located is nearly surrounded by private land with restricted access.

Northern Natural Gas Company, Exxon Company, and others operate in the vicinity of Leon Creek and are cautious to avoid adverse impacts on the area. The Trans-Pecos Soil and Water Conservation District, in cooperation with the Soil Conservation Service, constructed a protective dike around Diamond-Y Spring to insure that an oil spill will not reach this habitat.

In 1976, a management effort was undertaken in Leon Creek to preserve Cyprinodon bovinus (Hubbs 1980). Following renovation efforts, care was exercised to return C. bovinus and G. nobilis to the lower section of Leon Creek (Hubbs et al. 1978). The endangered status afforded G. nobilis by the Endangered Species Act of 1973 is a major deterrent to taking of G. nobilis. Section 7 of the Act directs Federal agencies to institute conservation and restoration programs for endangered species. The Act also specifically forbids activities of Federal agencies that might jeopardize the survival of endangered species or alter critical habitat. Leon Creek was designated as critical habitat for C. bovinus in 1980. This action also provides protection for G. nobilis habitat.

Landowners provide additional protection to various populations of G. nobilis in New Mexico and Texas because of limited access and responsible protective measures. The populations on Bitter Lake National Wildlife Refuge and Salt Creek Wilderness Area are located on Federal property. Access to these areas is restricted. The refuge manager is aware of the needs of the species and is alert to help prevent potentially hazardous situations. Hatch and Conway (1980) developed a management plan for G. nobilis on the refuge.

LITERATURE CITED

Baird, S. F. and C. Girard. 1853. Descriptions of new species of fishes collected by Mr. John H. Clark on the U.S. and Mexican Boundary Survey, under Lt. Col. Jas. D. Graham. Proc. Acad. Nat. Sci., Phila. 6:387-390.

Bednarz, J. C. 1975. A study of the Pecos gambusia. Research report of the endangered species program, New Mexico Department of Game and Fish, Santa Fe, New Mexico. 1-30.

_____. 1979. Ecology and status of the Pecos gambusia, Gambusia nobilis (Poeciliidae), in New Mexico. Southwest. Nat. 24:311-322.

Behnke, R. J. 1974. Endangered species report, Gambusia nobilis. Colorado State University, Fort Collins, Colorado.

Echelle, A. A. and A. F. Echelle. 1980. Status of the Pecos gambusia, Gambusia nobilis. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. Endangered Species Report No. 10. 1-73.

Gehlbach, F. R., C. L. Bryan, and H. W. Reno. 1978. Thermal ecological features of Cyprinodon elegans and Gambusia nobilis, endangered Texas fishes. Texas J. Sci. 30:99-101.

Girard, C. 1859. Ichthyology of the Boundary, In: United States and Mexican Boundary Survey, under the order of Lt. Col. W. H. Emory, Major First Cavalry and United States Commissioner. Washington 2:1-85.

Hatch, M. D. and M. C. Conway. 1980. Management plan for the Pecos gambusia, Gambusia nobilis (Baird and Girard, 1853) on the Bitter Lake National Wildlife Refuge. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

Hubbs, C. 1980. The solution to the Cyprinodon bovinus problem: Eradication of a pupfish genome. Proc. 10th Desert Fishes Council 9:18.

_____, and E. A. Delco, Jr. 1960. Mate preference in males of four species of gambusine fishes. Evolution 14:145-152.

_____, and A. A. Echelle. 1972. Endangered nongame fishes of the upper Rio Grande basin. In: Symposium on Rare and Endangered Wildlife of the Southwestern United States. New Mexico Dept. of Game and Fish, Santa Fe.

_____, and V. G. Springer. 1957. A revision of the Gambusia nobilis species group with descriptions of three new species, and notes on their variation, ecology, and evolution. Texas J. Sci. 9:279-327.

_____, T. Lucier, E. Marsh, G. P. Garrett, R. J. Edwards, and E. Milstead. 1978. Results of an eradication program on the ecological relationships of fishes in Leon Creek, Texas. Southwest. Nat. 23:487-496.

Hubbs, C. L. 1926. Studies of the fishes of the order Cyprindontes. VI. Material for a revision of the American genera and species. Univ. Mich., Mus. Zool. Misc. Pub., 16:1-87.

_____. 1961. Isolating mechanisms in the speciation of fishes. In: Blair, W. F., Vertebrate Speciation. The University of Texas Press, pp. 5-23.

Koster, W. J. 1957. Guide to the Fishes of New Mexico. Univ. New Mexico Press, Albuquerque, New Mexico. 1-116.

Miller, R. R. 1961. Man and the changing fish fauna of the American southwest. Pap. Mich. Acad. Sci. 46(1960):365-404.

Minckley, W. L. and J. A. Deacon. 1968. Southwest fishes and the enigma of "endangered species." Science 159(3810):1424-1432.

Moore, W. S. and F. E. McKay. 1971. Coexistence in unisexual-bisexual complexes of Poeciliopsis (Pisces: Poeciliidae). Ecology 52:791-799.

Peden, A. E. 1970. Courtship of Gambusia (Poeciliidae) with emphasis on isolating mechanisms. Unpubl. Ph.D. dissertation, University of Texas, Austin.

Regan, C. T. 1913. A revision of the cyprinodont fishes of the subfamily Poeciliidae, Proc. Zool. Soc., London 977-1018.

Rivas, L. R. 1963. Subgenera and species groups in the poeciliid fish genus Gambusia Poey. Copeia 1963:331-347.

Sublette, J. E. and D. E. Crowley. 1979. A seasonal survey of the fishes of the Black River drainage, Eddy County, New Mexico. Final report to New Mexico Dept. of Game and Fish. 132 pp.

Winkler, P. 1979. Thermal preference of Gambusia affinis as determined under field and laboratory conditions. Copeia 1979:60-64.

PART II - THE ACTION PLAN

The ultimate goal of the recovery plan is to improve the status of the Pecos gambusia to the point that survival is secured and the species can be downlisted. This goal should result from implementation of the recovery plan.

RECOVERY PLAN STEPDOWN OUTLINE

Primary objective: Improve the status of the Pecos gambusia, *Gambusia nobilis*, to the point that survival of the populations from the four major areas of occurrence is secured.

1.0 Maintenance and enhancement of existing Pecos gambusia populations and habitats.

- 1.1 Monitor Pecos gambusia populations and their habitats.
  - 1.11 Monitor populations.
  - 1.12 Monitor habitats.
- 1.2 Evaluate, protect and enhance Pecos gambusia habitat.
  - 1.21 Protect major areas of occurrence.
  - 1.22 Protect and maintain water sources critical to G. *nobilis* survival.
  - 1.23 Protect and enchance G. *nobilis* habitat.
- 1.3 Regulate the introduction of novel fishes into Pecos gambusia habitat.
- 1.4 Preclude immigration of novel fishes.
- 1.5 Study ecological factors.
- 1.6 Determine systematic relationships within G. *nobilis*.
- 1.7 Remove exotic fishes.

2.0 Reestablish Pecos gambusia within portions of its historic range.

- 2.1 Survey habitats to identify sites with suitable characteristics for Pecos gambusia.

2.2 Select potential sites for restoration.

2.3 Carry out any remedial actions necessary to make candidate habitats suitable for transplants.

2.4 Transplant Pecos gambusia from pure populations into selected restoration sites.

2.5 Monitor the establishment of Pecos gambusia in restoration sites.

2.6 Reintroduce other sympatric native fish species after Pecos gambusia are established in selected restoration sites.

2.7 Establish stocks of Pecos gambusia for use in mosquito control.

3.0 Disseminate information about Pecos gambusia.

3.1 Public information.

3.11 Local and State.
3.12 National.

3.2 Professional information.

4.0 Hold and propagate Pecos gambusia in a hatchery.

STEPDOWN NARRATIVE

Primary Objective: Improve the status of the Pecos gambusia, Gambusia nobilis, to the point that survival of the populations from the four major areas of occurrence is secured.

1.0 Maintenance and enhancement of existing Pecos gambusia populations and habitats.

Steps should be taken to maintain and to enhance existing populations and their habitats in the four major areas of occurrence.

1.1 Monitor Pecos gambusia populations and their habitats.

1.11 The populations of Pecos gambusia should be monitored on a long term basis with the focus on numbers, condition and age structure of fish, and on condition of habitat. Should any of these or other factors suggest a decline in the population or the degradation of habitat, causative factors should be identified and corrected.

1.12 Any proposed activity within a watershed which may affect adversely the Pecos gambusia or its habitat should be critically reviewed. Examples include introduction of exotics, road construction, oil and gas field activities, pumping of ground water, surface water diversions, management of phreatophytes, and the use of chemical agents. Activities that can negatively affect the survival or maintenance of populations of the Pecos gambusia should be discouraged in the private sector and not be permitted in the public sector.

1.2 Evaluate, protect, and enhance deficient Pecos gambusia habitat.

1.21 If populations occurring on private property can be managed effectively and protected only by conservation easement on property and/or water rights by the U.S. Fish and Wildlife Service, then this action should be pursued.

1.22 The need for a long term, dependable water source is a basic habitat requirement of the Pecos gambusia. Irrigation and domestic water demands have dried up some of the original waters and springs that contained the Pecos gambusia. Human demand for water in New Mexico and Texas is not likely to decrease and unprotected water sources will continue to be altered for human use. Habitats occupied by the Pecos gambusia should be monitored to ensure adequate perennial water. Where overutilization of ground water exists, these habitats should be protected.

1.23 The riparian vegetation within a watershed is a key factor in the protection and maintenance of the Pecos gambusia. Removal or reduction of vegetation may cause or accelerate such detrimental situations as soil erosion, flooding, and undesirable water chemistry or stream configurations. For example, in 1978 and 1979 Blue Spring was subjected to a large influx of silt that temporarily filled many of the deeper portions of the spring run. This siltation resulted from erosion associated with a pipeline installation above the springhead. Where watershed vegetation is deficient, remedial action should be prescribed and implemented, including planting of vegetation and control of grazing. Proposed procedures to enhance Pecos gambusia habitats should be evaluated and any detrimental procedures should be avoided.

1.3 Regulate the introduction of novel fishes into Pecos gambusia habitat.

The addition of a novel species into individual Pecos gambusia habitats has the potential for a variety of adverse impacts on G. nobilis, including predation, hybridization, competitions, and habitat modification. No fish species should be introduced into G. nobilis habitat or nearby associated waters, unless a release plan has been approved by appropriate regulatory agencies.

All agencies involved with endangered species management, mosquito control programs, and fish stocking should be made aware of the distribution of the Pecos gambusia and the potential hazard of the introduction of fish to individual Pecos gambusia habitats. Purposeful or inadvertent introductions by government agencies or private concerns should be discouraged by law and/or by increased public awareness. Executive Order 11987 instructs Federal agencies to restrict the introduction of exotic species into natural ecoystems.

1.4 Preclude immigration of novel fishes.

Physical barriers are essential to prevent entry of novel fishes, especially Gambusia, into the habitats of G. nobilis. The ability of existing barriers to isolate the Pecos gambusia from these fish should be evaluated. If any existing barrier loses its effectiveness, the replacement or enhancement of that barrier should be planned carefully and executed in harmony with the natural environment. New barriers should be constructed wherever necessary to protect the Pecos gambusia.

1.5 Study ecological factors.

Management efforts to perpetuate survival of G. nobilis will be assisted by a fuller understanding of ecological factors controlling abundance of the species, such as water quality, fecundity, feeding and food habits, competition for food and space, and hybridization potential.

1.6 Determine systematic relationships within G. nobilis.

As discussed in Part I of the recovery plan, there is considerable evidence that the various populations of G. nobilis are morphologically and/or electrophoretically differentiated. Many management decisions depend on a knowledge of the degree that the different populations of G. nobilis represent unique genetic units. An electrophoretic and morphological study is recommended for each G. nobilis population in the four major areas of occurrence (Table 3). Sufficient sample collections should be made to allow analysis of local differentiation within each major area, emphasizing the need to determine geographic variation across the range of the species. The number of samples will vary and depend on the area of concern and whether or not preliminary analysis suggests local differentiation occurs and warrants additional quantification efforts.

1.7 Remove exotic fishes.

Native fishes, which evolved in communities with low species diversity, are often unable to compete with introduced species. Although the effects of competition on G. nobilis are well known, available data indicate that they are disappearing in the Balmorhea area because of the expansion of G. geiseri, a nonnative poecillid introduced into the springs in the early 1930s. Other potential effects of the introduction of exogenous species include predation, hybridization, and introduced diseases.

2.0 Reestablish Pecos gambusia within portions of its historic range.

The Pecos gambusia no longer occurs in four of the nine historic collection areas and is diminished in abundance in at least one remaining area. Stocking of the Pecos gambusia within the known range should be done when possible (see Appendix A). Introduction of Pecos gambusia into new locations should be considered as an alternative to perpetuate survival of the population of any one major area. Because of the hazard posed by the introduction of G. affinis, any biological control of mosquitoes in the middle Pecos River drainage should emphasize G. nobilis as the vector control agent.

2.1 Survey habitats to identify sites with suitabla characteristics for Pecos gambusia.

Factors that should be considered prior to final selection of restoration habitats are outlined in Appendix A.

2.2 Select potential sites for restoration

Potential restoration sites can be selected according to the criteria outlined in Appendix A.

2.3 Carry out any remedial actions necessary to make candidate habitats suitable for transplants.

See Appendix A for specific characteristics that need to be satisfied.

2.4 Transplant Pecos gambusia into selected restoration sites from pure populations.

A degree of differentiation has been observed between populations inhabiting the four major areas of occurrence of G. nobilis (Table 3). Each is considered vital to the survival of the species. Therefore, one or more separate transplants from each major area of occurrence should be made to ensure that the genetic diversity of the species is maintained.

The G. nobilis individuals being transplanted into a restoration habitat should be selected from the nearest natural population. For example, the population in Blue Spring should be used in the Black River and adjacent drainages. Likewise the Leon Creek population should be employed in the Fort Stockton area.

Where G. nobilis occurs with other congeners, efforts should be made to isolate and to maintain a pure stock at a hatchery facility to accommodate any transplant needs. By developing these stocks, the risk of transplanting hybrid or exotic gambusia into a restoration habitat is eliminated; however, transplants should be made from nearby natural stocks whenever possible, as discussed above and in Appendix A.

2.5 Monitor the establishment of Pecos gambusia in restoration sites.

The establishment of Pecos gambusia in restoration sites should be closely monitored to document reproductive success, survival of young, growth rates, and other parameters while the population is still below carrying capacity.

2.6 Reintroduce other sympatric native fish species after Pecos gambusia are established in selected restoration sites.

After an establishment period during which the population characteristics of the Pecos gambusia in the restoration habitat(s) have been evaluated thoroughly in accordance with item 2.4, native fish species which were present prior to reclamation should be considered for reintroduction. Logically, reintroductions should be made one species at a time in order to document the effects of that species on the already established population of Pecos gambusia.

2.7 Establish stocks of Pecos gambusia for use in mosquito control.

Stocks of Pecos gambusia should be established for use in mosquito control programs in each of the four major areas where the species presently occurs. The use of Pecos gambusia in these programs will help preclude the immigration of exotic fish, especially exotic Gambusia.

3.0 Disseminate information about Pecos gambusia.

Information concerning Pecos gambusia should be disseminated to provide knowledge and understanding of the Pecos gambusia and to promote support and confidence in the recovery effort.

3.1 Public information.

Besides providing basic information on the species, a good information program can stimulate public support for expanding the Pecos gambusia in its historic range.

3.11 Local and State.

Pecos gambusia information should be disseminated to the public locally and statewide to reach as large and as varied an audience as possible. Media to be used include newspapers, State conservation magazines, radio, and television. Programs should be prepared for broadcast on respective State television programs.

3.12 National.

Information concerning Pecos gambusia should also be supplied to media that have national coverage.

3.2 Professional information.

Technical information will be made available through appropriate media, including scientific journals, agency reports, and regulations concerning the species.

4.0 Hold and propagate Pecos gambuGia in a hatchery.

Pecos gambusia have been raised by the U.S. Fish and Wildlife Service at Dexter National Fish Hatchery, Dexter, New Mexico, and jointly by the New Mexico Department of Game and Fish and the New Mexico Environmental Improvement Division at Carlsbad, New Mexico. Both programs recently were terminated; however, propagation should be

reinstated when suitable additional habitat is identified, and translocations from existing populations are not justified. These efforts to hold and to propagate Pecos gambusia prove the feasibility of stocking alternate habitats as discussed in item 2.4.

Similar propagation programs should be reinstated, if the existence of any Pecos gambusia population is seriously threatened. Stock from the threatened population should be transplanted into a suitable habitat as soon as possible. However, if a transplant is not immediately feasible, individuals from that population should be moved to a hatchery that can serve as a refugium and as source of stock for later reintroduction.

The hatchery site should have fish cultural facilities designed so that G. nobilis can be isolated effectively from other gambusiine fishes.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	RESPONSIBLE AGENCY FWS PROGRAM (6a)	RESPONSIBLE AGENCY OTHER (7)	FISCAL YEAR COSTS (EST.) FY83 (8)	FY84	FY85	COMMENTS (9)
M3	Maintain and enhance population and habitat	1.0	2	ongoing	2	mgmt.	NMGF TPWD				
I6	Monitor populations	1.1	2	ongoing	2	mgmt.	NMGF TPWD				Composed of tasks 1.1 to 1.12.
M3	Evaluate, protect, and enhance marginal habitat	1.2	3	ongoing	2	mgmt.	NMGF TPWD	5,000	10,000	10,000	Composed of tasks 1.2 to 1.23; *
M4	Regulate introduction of other fishes	1.3	2	ongoing	2	mgmt.	NMGF TPWD				
M4	Preclude immigration of novel fishes	1.4	3	ongoing	2	mgmt.	NMGF TPWD	2,000	2,000	2,000	
R3	Study ecological factors	1.5	3	2 yrs.	2	research	NMGF TPWD				
15	Determine systematics of G. nobilis	1.6	3	2 yrs	2	research		2,000	3,000	3,000	
M4	Remove exotic fishes	1.7	3	4 yrs.	2	mgmt.	NMGF	2,000	2,000	2,000	
M2	Reintroduce G. nobilis into historic range	2.0	3	4 yrs.	2	mgmt.	NMGF TPWD				

*Costs refer to USFWS expenditures only.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	FWS PROGRAM (6a)	OTHER (7)	FISCAL YEAR COSTS (EST.) FY83 (8)	FY84	FY85	COMMENTS (9)
R13	Survey habitats prior to reintroduction of G. nobilis	2.1	3	3 yrs.	2	research	NMGF TPWD				
M2	Select reintroduction sites	2.2	3	3 yrs.	2	mgmt.	NMGF TPWD				
M3	Enhance potential re-introduction sites	2.3	3	3 yrs.	2	mgmt.	NMGF TPWD	1,000	2,000	2,000	
M2	Reintroduce G. nobilis	2.4	3	3 yrs.	2	mgmt.	NMGF TPWD				
I1 & 2	Monitor reintroductions	2.5	3	5 yrs.	2	research	NMGF TPWD				Will not occur before FY86.
M3	Reintroduce sympatric native fishes	2.6	3	1 yr.	2	mgmt.	NMGF TPWD				
M1	Establish stocks of G. nobilis for mosquito control	2.7	3	ongoing	2	propagation	NMGF TPWD	2,000	5,000	5,000	
01	Disseminate information	3.0	3	ongoing	2	education	NMGF TPWD	1,000	1,000	1,000	
01	Public information	3.1	3	ongoing	2	education	NMFG	1,000	1,000	1,000	Composed of tasks 3.11 and 3.12 *

*Costs refer to USFWS expenditures only.

PART III - IMPLEMENTATION SCHEDULE

GENERAL CATEGORY (1)	PLAN TASK (2)	TASK # (3)	PRIORITY # (4)	TASK DURATION (5)	RESPONSIBLE AGENCY FWS REGION (6)	RESPONSIBLE AGENCY FWS PROGRAM (6a)	RESPONSIBLE AGENCY OTHER (7)	FISCAL YEAR COSTS (EST.) FY83 (8)	FY84	FY85	COMMENTS (9)
01	Professional information	3.2	3	ongoing	2	education	NMGF TPWD	500	500	500	
M1	Propagation of G. nobilis	4.0	3	ongoing	2	propagation	NMGF TPWD	2,000	2,000	2,000	Will continue until G. nobilis is de-listed. *

*Costs refer to USFWS expenditures only.

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

U.S. FISH & WILDLIFE SERVICE

M

TO: Regional Director, FWS, Albuquerque, NM (SE)

DATE: September 1982

FROM: Manager, Bitter Lake NWR, Roswell, NM

SUBJECT: Pecos Gambusia Recovery Plan

We have reviewed the draft of the subject plan and find it to be most comprehensive and favorable to the continued existence of the Pecos gambusia (Gambusia nobilis).

C-1 However, in the interest of providing correct descriptions of all of the waterways in which the Pecos gambusia is found, we would suggest that Lost River, here on the refuge, be mentioned under Present Distribution in New Mexico (Page 4).

Mention is made of Dragonfly Spring, which feeds into Lost River, but no mention is made of Lost River on this page. It is pointed out on page 10 under Abundance, however, that Lost River's population of Pecos gambusia was estimated at 10,700 fish. We just wanted to bring this oversight to you attention.

C-2 While on the subject of Lost River, we wonder if anyone has sought out its source, which is reportedly above ground somewhere to the northwest of the refuge. None of us here on the refuge have ever looked for it, but it probably should be checked out as a possible gambusia habitat.

C-3 Also, we find no record that anyone has surveyed the small springs found along the west sides of Impoundment Units 3 and 6 of the refuge. These springs, although small, seem to us like possible habitat.

Thank you for this opportunity to review and comment on the draft plan.

Lee Marlatt

L. B. Marlatt

cc: Region 2 (RF)

cc: All Rio Grande Fishes Members/9-14-82/vah

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

FWS REG 2
RECEIVED
SEP 1[illegible]'82
SE

iro

IN REPLY REFER TO

6840 (931)

RECEIVED
PLANNING

e&T 13 '82

United States Department of the Interior

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

OCT 1 2 1982

Memorandum

To: Regional Director, Region 2, USFWS, Albuquerque, NM

From: SlaLe DireeLot, I.i, anta re,

Subject: Pecos Cambusia Recovery Plan Review

In response to your memorandum dated August 26, 1982, the following comments are provided on the Pecos Cambusia Recovery Plan.

C 4-6 **The Pecos River drainage area in the southeastern portion of the State is a major oil and gas production area and any reintroduction efforts of this species could create compromising situations for BLM managers. We recommend that the recovery plan address surface management restrictions or possible restrictions that could occur in areas selected for reestablishment of Pecos Gambusia. In this same context, the Recovery Plan should address any mitigating circumstances available to surface land managers.**

It should be clearly recognized by the Pecos Gambusia Recovery Team that any **reestablishment or habitat restoration** projects **involving the management of BLM-administered lands must be closely coordinated with BLM managers.**

Thank you for the opportunity **to review this recovery** plan.

cc: **All Rio Grande Fishes Recovery Team** Members/10-27-82/Vah

2

United States Department of the Interior

BUREAU OF RECLAMATION
SOUTHWEST REGION
COMMERCE BUILDING, 714 S. TYLER, SUITE 201
AMARILLO, TEXAS 79101

IN REPLY
REFER TO: 150

OCT 5 1982

Pecos Gambusia
Rec Plan

Memorandum..

To: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico

From: Regional Director

Subject: Review of Draft Pecos Gambusia Recovery Plan

The Southwest Region of the Bureau of Reclamation (Bureau) has reviewed the subject recovery plan and has the following comments.

C 8 In general, the recovery plan fails to address, with specifics, the immediate needs of the Pecos gambusia. Recommending protection and enhancement and providing for "adequate" perennial water are commendable goals; but if specific concrete methods to attain these goals are not spelled out in the Recovery Plan, as well as some assessment of their feasibility, then the immediate needs of the Pecos gambusia will not be met.

C 9 Each of the four general areas of Pecos gambusia occurrence (page 16) should be investigated as to adequacy of present and estimated future water supply, the potential for accurate monitoring of populations and habitat changes, and the feasibility of regulating the introduction of exotic species and/or their removal. In this manner the actual potential for real and lasting protection of the Pecos gambusia at each site could be determined and money programed in the Recovery Plan where it can do the most good.

C-10 Page 10, last paragraph, first sentence. Change to read "Presently, six endemic poeciliids confined to springs and their associated outflow streams in Texas, New Mexico, ana Arizona are listed as endangered."

C-11 Page 11, first paragraph. As Brantley Dam will be replacing McMillan Dam, the total number of dams on the Pecos will not, in fact, increase.

C-12 With regard to the "drying of the river," it might be more accurate to state that water use in the area (irrigation, municipal and industrial use, ground water pumping, etc.) has depleted the flows of the Pecos River. The present implication is that the existing dams are the only cause of flow depletions. We also recommend that historic flows at several locations in the Pecos River be reviewed and compared to the present before assuming that the river was never "dry" prior to the construction of dams on the river.

-4

cc: All Team Members-Rio Grande Fishes/10-22-82/vah

-4

C13 Page 22, Section 1.0. The Bureau and the Reeves County Water Improvement District No. 1 (District) are interested in specific measures that would be employed in the Balmorhea area for the protection of the Pecos gambusia. The Bureau owns 17.56 acres surrounding Phantom Lake Spring, and the District operates and maintains the Phantom Lake Spring Canal. How specifically does Phantom Lake Spring fit into the Recovery Plan? If specific protection measures are anticipated for Phantom Lake Spring, we reconuend that a primary task of the Recovery Plan be the development of a management plan through consultation with the Bureau and District.

end Comment

GOVERNOR

DIRECTOR AND SECRETARY
TO THE COMMISSION

State of New Mexico

STATE GAME COMMISSION

DEPARTMENT OF GAME AND FISH

October 19, 1982

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

Dear Mike:

Enclosed is a copy of the Agency Review Draft of the Pecos Gambusia (Gambusia nobilis) Recovery Plan with our editorial comments. Obviously, a great deal of thought and effort has gone into the plan, and we offer our congratulations to the team. However, we do have some reservations with the present version of the plan as indicated below.

C-14 Our major concern is that the implementation schedule, part III of the plan, has not been completed. This is one of the most important parts of the plan, and it is critical that we have an opportunity to review this before we can endorse the plan. In addition, we have made several comments concerning the technical content of the plan, indicated on the attached draft.

We look forward to reviewing a complete draft of this plan.

Sincerely,

Harold F. Olson
Director

ls

FWS REG 2
RECEIVED
OCT 22 '82

TEXAS
PARKS AND WILDLIFE DEPARTMENT

SF

CHARLES D. TRAVIS
EXECUTIVE

4200 Smith School Rod
Austin, Texas 78744

October 25, 1982

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

Dear Mr. Spear:

This is in response to your letter of September 2, 1982 regarding the Agency Review Draft of the Pecos Gambusia Recovery Plan.

We have reviewed the plan and find it to be a realistic approach to solving the survival problems of the Pecos
C 15 gambusia. Our minor comments have been incorporated in the returned draft.

We appreciate the opportunity to review the document.

Sincerely,

Charles D. Travis
Executive Director

CDT:FP:lf

Enclosure

FWS REGION 2
RECEIVED
OCT 27 '82

RECEIVED
OCT 28 1982

U[illegible] S[illegible] D[illegible] the Interior

ONLY THE DIRECTOR
AND WILDLIFE SERVICE

FISH AND WILDLIFE SERV CE
WASHINGTON, D.C. 20240

I[illegible] R[illegible] R[illegible] T[illegible] ;
FWS/OES

M[illegible]

T[illegible]: R[illegible] D[illegible], R[illegible] 2 (ARD/AFF)

F[illegible]: D[illegible]

S[illegible]: P[illegible] Gambusia R[illegible] P[illegible] - A[illegible] D[illegible]

W[illegible]. A[illegible] O[illegible] E[illegible] S[illegible].

W[illegible]:

1. P[illegible] 4 - T[illegible]. R[illegible].

2. P[illegible] 12 - A[illegible] we[illegible] (i.e., [illegible], waterflow, [illegible]). T[illegible] "Temperature"[illegible] "Salinity"[illegible] "H[illegible]." T[illegible] "[illegible] cover"[illegible].

W[illegible]? D[illegible], [illegible]? P[illegible].

3. P[illegible] 15 [illegible] 17, C[illegible] E[illegible] P[illegible] M[illegible] I[illegible], i.e., [illegible] 15 [illegible] R[illegible]. I[illegible] B[illegible] S[illegible]? I[illegible].

4. P[illegible] 20, I[illegible] - T[illegible] following phrase[illegible] [illegible] "...and[illegible]."

P[illegible] — D[illegible]. I[illegible] delisted[illegible].

T[illegible] 1.22 [illegible] 1.23 [illegible] N[illegible] ([illegible] 22 [illegible] 23) [illegible] S[illegible]-[illegible] O[illegible].

FWS REG 2

2'82

Task 1.7 - Delete the parenthetical expression. There are other species besides geiseri which are exotics in the nobilis areas, e.g., affinis.

5. Page 22 - Task 1.21 needs to be expanded to indicate what measures are needed to protect the areas of major occurrence. The descriptions on pages 15 and 17 give a clue as to the protection measures for some of the areas but does not appear to include the Blue Springs area. The Narrative for 1.21 lists what is to be done as a last resort but it does not list what is to be done before resorting to the "last resort." Please correct this omission.

6. Page 23 - The following comments (Item 1.3, 1.4, and 1.5) were included in the technical draft review but have not been incorporated in the agency draft. We resubmit the comments:

Item 1.3 - Specify what is meant by "adverse impacts" and "unusual circumstances." Executive Order 11987 signed May 24, 1977, instructs Executive agencies "to the extent permitted by law, restrict the introduction of exotic species into the natural ecosystem." This should be mentioned in the Narrative.

Item 1.4 - Where are the existing barriers? What additional locations are needed? What types of barriers are acceptable?

Item 1.5 - Discuss the information needs of each study more specifically. What information gaps exist?

Subtasks 1.51, 1.52, and 1.53 should be discussed in the Step-down Narrative.

7. Page 24 - Task 1.7 considers only geiseri and the Balmorhea area. Other areas and species should be mentioned if they are a problem, e.g., affinis in Leon Creek area and other areas. The scientific names in this section should be underlined.

8. Page 26, first paragraph - Task 4.0 in the technical draft indicated that the two attempts to raise the Pecos gambusia in hatcheries were successful. The agency draft does not emphasize as strongly the success of these efforts. Please clarify the feasibility of rearing and reintroducing the species. This is particularly important with the new ESA amendments which include the concept of experimental populations.

In our review of the technical dratt we raised the following issue relative to task 4.0:

"Propagation should be reinstituted when suitable additional habitat is identified, translocations from existing populations are not justified, and/or the expense is justified. What criteria should he used to trigger this action? Be specific." The issue of propagation and reintroduction should be addressed in more detail if possible.

This agency draft does not have an Implementation Schedule and as such it is an incomplete draft. Recognizing that you have a team meeting in the near future we have reviewed that portion of the plan which is available.

If you feel that any of the specific or general comments do not warrant revisions for the next draft, please provide your rationale in the return cover memo.

The revised agency draft should he resubmitted with the Implementation Schedule for review. This office will expedite the review of the agency draft once we receive it.

Questions concerning this matter should he directed to Larry Thomas, Office of Endangered Species, FTS 235-2760.

Ronald E. Lambertson

RESPONSES TO COMMENTS

C-1 Lost River was included under Present Distribution on Page 4.

C-2,3 Field biologists of the New Mexico Department of Game and Fish and the recovery team were given copies of these comments.

C-4 Responsibility of the BLM in regard to listed species is described in Section 7 of the Endangered Species Act of 1973, as amended. Reintroduction of listed species into isolated habitats can be made under the new designation, Experimental, nonessential, that will give those populations the same status as candidate species (no Federal protection under the Act).

C-5,6 See C-4 above and tasks 1.21, 1.22, and 1.23 of this recovery plan. Mitigation of the taking of Endangered Species or destruction of Critical Habitat is not acceptable under the Endangered Species Act. Actions must be taken to eliminate the impact, or at least that it result in an overall benefit to the species.

C-7 Coordination among responsible State and Federal agencies and private interests is recognized as being necessary for all recovery actions, and will be encouraged with BLM concerning areas around Blue Spring in New Mexico.

C-8,9 See tasks 1.2 and 1.5 and Appendix A.

C-10 Done.

C-11 Done.

C-12 Done.

C-13 See task 1.23 and refer to the Comanche Springs Pupfish Plan. The Bureau of Reclamation should consider an interagency agreement with FWS to write the management plan mentioned.

C-14 The New Mexico Department of Game and Fish reviewed the implementation schedule in this recovery plan and their technical comments were incorporated.

C-15 Comments by the Texas Parks and Wildlife Department were incorporated.

C-16 All comments and suggestions made by the Associate Director were incorporated into the recovery plan where appropriate.

APPENDIX A. FACTORS THAT SHOULD BE CONSIDERED PRIOR TO SELECTION OF RESTORATION HABITATS

A. The ability to completely eliminate other Gambusia, including their hybrids, by either physical and/or chemical methods, should be assured. Continued isolation of the Pecos gambusia from other gambusiine fishes must be assured.

B. Potential restoration should be evaluated and documented in terms of physical, chemical, and biological factors of the stream. In the past, high concentrations of dissolved solids, hardness, and salinity may have led to unsuccessful transplants.

C. The ecological stability of potential restoration sites should be evaluated on the basis of stream flows under both drought and flood conditions.

D. The presence of other endangered or unique species in candidate restoration sites should be determined, and the potential impacts of barrier construction, toxicant application, and Pecos gambusia introduction should be assessed.