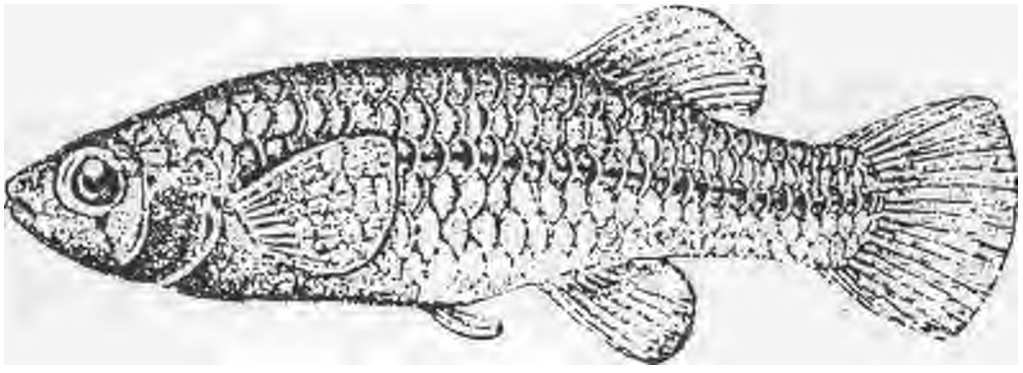
BIG BEND GAMBUSIA

RECOVERY PLAN



FISH & WILDLIFE SERVICE

1984

Albuquerque, New Mexico

RECOVERY PLAN

FOR

BIG BEND GAMBUSIA

Gambusia gaigei Hubbs, 1929

PREPARED FOR

THE U.S. FISH AND WILDLIFE SERVICE

BY

THE RIO GRANDE FISHES RECOVERY TEAM

APPROVED: _____
Regional Director, Region 2

DATE: 1/19/84

SUMMARY

1. P[illegible] delisting:

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2. W[illegible]:

   S[illegible] habitats[illegible]. T[illegible].

3. M[illegible]:

   T[illegible] monitor[illegible].

DISCLAIMER

This is the completed Big Bend Gambusia Recovery Plan. It has been approved by the U.S. Fish and Wildlife Service. It dces not necessarily represent official positions or approvals of cooperating agencies and it does not necessarily represent the views of all recovery team members/ individuals, who played the key role in preparing the 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 obtained and funds will be expended contingent upon appropriations, priorites, and other budgetary constraints.

The Big Bend Gambusia Recovery Plan dated September, 1984, was prepared by the U.S. Fish and Wildlife Service in cooperation with the Rio Grande Fishes Recovery Team.

The recovery plan is based upon the belief that State and Federal conservation agencies and knowledgeable, interested individuals should endeavor to preserve the Big Bend 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 members have used the best information available to them and 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 Big Bend gambusia and the Rio Grande Village ecosystem 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, especially the National Park Service, Texas Parks and Wildlife Department and the U.S. Fish and Wildlife Service.

ACKNOWLEDGMENTS

The Big Bend Gambusia Recovery Plan, dated September 17, 1984, was prepared by the U.S. Fish and Wildlife Service in cooperation with the Rio Grande Fishes Recovery Team composed of the following individuals:

Dr. Clark Hubbs, Department of Zoology, University of Texas, Austin, TX
Dr. Salvador Contreras-Balderas, Universidad Autonoma de Nuevo Leon, Monterrey, Mexico
Dr. Anthony Echelle, Biological Sciences, Oklahoma State University, Stillwater, OK
Mr. Buddy Jensen, Dexter National Fish Hatchery, Dexter, NM
Mr. Michael D. Hatch, New Mexico Department of Game and Fish, Santa Fe, NM
Mr. Floyd Potter, Texas Parks and Wildlife Department, Austin, TX

Other individuals instrumental in plan formulations include:

Mr. Gerard A. Hoddenbach, National Park Service, Santa Fe, NM
Mr. Gilbert Lusk, Park Superintendent, Big Bend National Park, TX
Mr. Mike Fleming, Resource Management Specialist, Big Bend National Park, TX
Mr. Bill Werrel, Water Resources Coordinator, National Park Service, Fort Collins, CO

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Additional copies may be obtained from:

Fish and Wildlife Reference Service
1776 E. Jefferson Street, 4th Floor
Rockville, Maryland 20852
Telephone: (301) 468-1737 Ext. 236 or 290
Toll Free - 1-800-582-3421

U.S. Fish and Wildlife Service
Office of Endangered Species
P.O. Box 1306
Albuquerque, New Mexico 87103
Telephone: (505) 766-3972

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PART I

BIG BEND GAMBUSIA RECOVERY PLAN

INTRODUCTION

The Big Bend gambusia (*Gambusia gaigei*) is a livebearing fish, up to 30 mm long, restricted to one spring outflow near Rio Grande Village in Big Bend National Park, Brewster County, Texas.

Threats to the species include a very limited total environment, a declining spring flow that maintains the environment, and competition with *Gambusia affinis*.

The species is a relatively plain, yellowish poeciliid whose faint lateral stripe is the most pronounced dark mark on the body. There is also a bar beneath the eye and a faint, dark chin bar. The male's anal fin is rolled into a tube-like gonopodium for transferring sperm into the female, has a pronounced elbow, with only one or two segments. Hubbs and Springer (1957) give a detailed description of the Big Bend gambusia.

TAXONOMIC STATUS

The Big Bend gambusia was described by Hubbs (1929). Rosen and Bailey (1966) considered *Gambusia gaigei* a senior synonym of *Gambusia hurtadoi* and *Gambusia alvarezi*, but this opinion was not accepted by Rivas (1963), Peden (1973), Alvarez (1970), or Miller (1978); G. *gaigei* remains a distinct species.

Most authors place the Big Bend gambusia in the Gambusia nobilis species group (Hubbs and Springer 1957, Minckley 1962, Peden 1973); however, Rivas (1963) divided the G. nobilis group into the G. nobilis and G. senilis groups and placed G. gaigei in the latter.

DISTRIBUTION AND DESCRIPTION OF THE HABITAT

The Big Bend gambusia is known only from spring habitats of Texas in the vicinity of Boquillas Crossing and Rio Grande Village in Big Bend National Park. The precise native occurrence is somewhat in question; the details are addressed in Hubbs, et al. (1977a). That study concluded that at least two populations originally existed—one at Boquillas Spring approximately 200 meters north of Boquillas Crossing and a second at Spring 4 just east of the present Rio Grande Village Campground (Figure 1). Other names for Boquillas Spring are Boquillas Crossing and Beaver Marsh Springs, and other names for Spring 4 are Campground Springs (Brune 1981), Weden Spring, Graham Ranch Warm Springs, Rio Spring, and Pumphouse Spring. Big Bend gambusia possibly once existed in other springs in the vicinity of Rio Grande Village (notably Spring 1.) The population once inhabiting Boquillas Spring is extinct and the population in Spring 4 has been extirpated. The Big Bend gambusia now consists of descendants of the Spring 4 population being maintained in a nearly natural park refugium (Fig. 2) and at Dexter National Fish Hatchery, New Mexico.

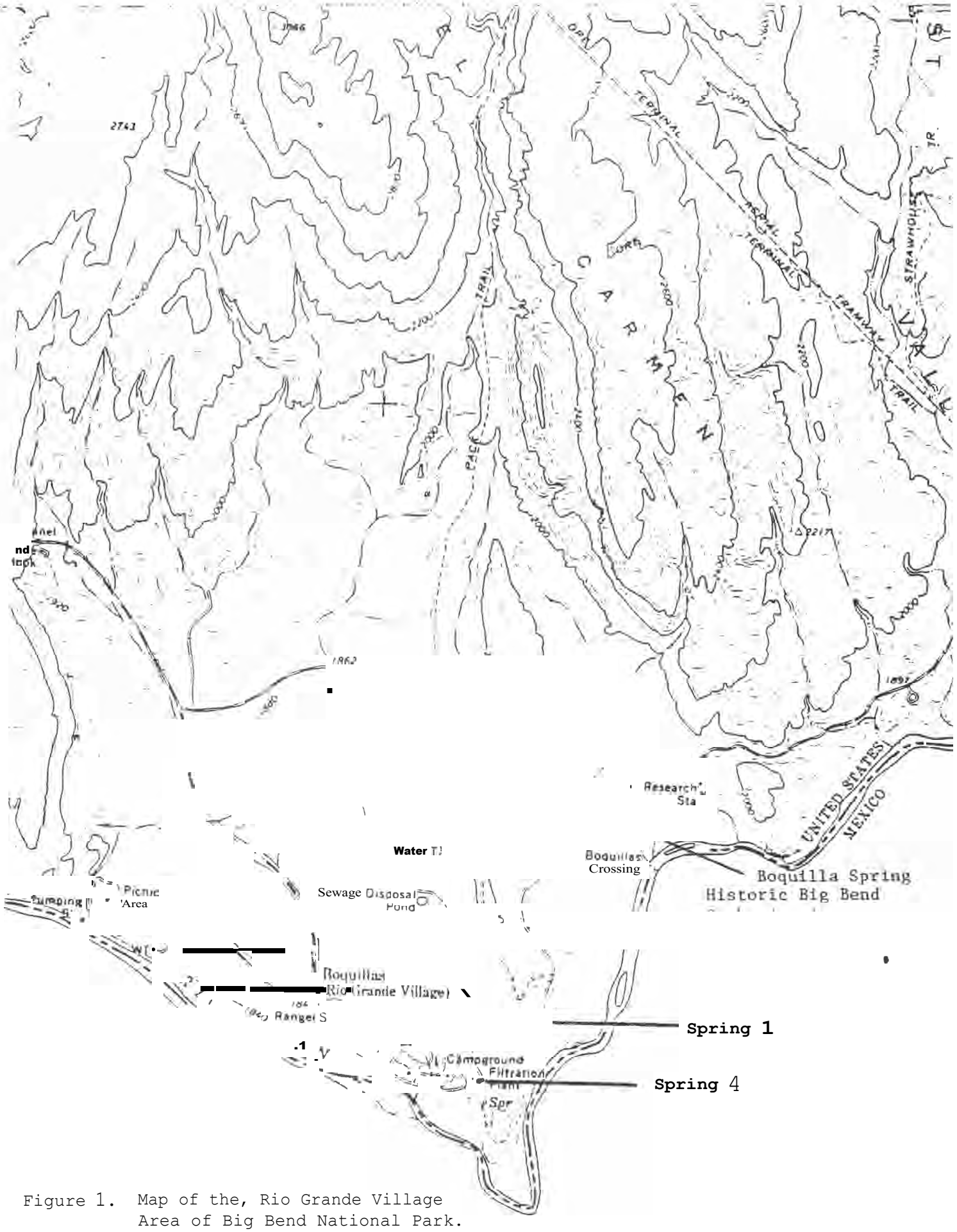

Figure 1. Map of the, Rio Grande Village Area of Big Bend National Park.

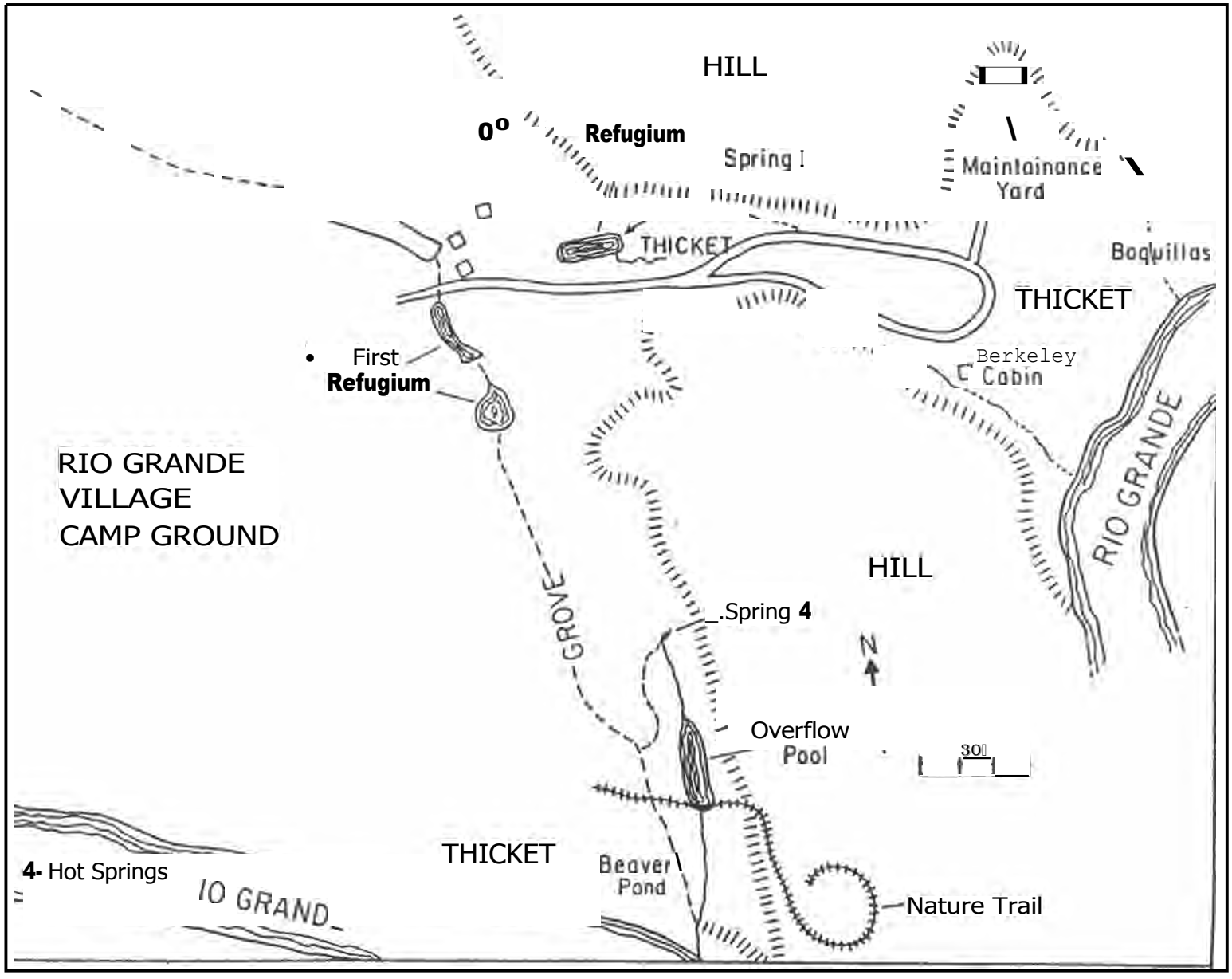

Figure 2. Rio Grande Village Campground showing location of Big Bend gambusia habitat.

The current stocks are all derived from three individuals taken from a declining Spring 4 population in 1956.

All documented natural occurrences of Big Bend gambusia are from spring outflows. The two springs of natural occurrence differ substantially in outflow temperature. Spring 4 has an outlet temperature of 32-35.5°C (Moore 1980) and Boquillas Spring had a temperature of about 23°C on March 6, 1982. However, the fish inhabiting Spring 4 did not live in the springhead itself (Hubbs 1959), but downstream where the temperature was influenced by ambient air temperatures. Recorded water temperatures (summers of 1954-56) from the Spring 4 outflow ditch, densely inhabited by Big Bend gambusia, were 28-32.5°C with air temperatures in the mid-20s. The temperatures in the large "overflow pool" (Figure 2), sparsely inhabited by Big Bend gambusia, were cooler and near ambient. Recorded temperatures from the ref ugium also fluctuate widely dependent upon air temperature and location.

The habitats originally occupied by the Big Bend gambusia were recorded as springfed marshes (Hubbs 1929). Dense aquatic vegetation (submerged and emergent) presumably occurred in clear, shallow water. Although the present refugium has open water with depths in excess of one meter, the Big Bend gambusia is most abundant among the vegetation (primarily Typha and Chara) near the shore.

In summary, the natural habitat occupied by G. gaigei was clear, shallow water fed by warm springs. Although the Big Bend gambusia will exist in other habitats, the rapid replacement by mosquitofish (Gambusia affinis) (see Threats) in eurythermal water suggests that the Big Bend gambusia

is best adapted to warm-spring areas. Other members of the Gambusia nobilis species group in U.S. waters also are abundant in springs, especially in those areas inhabited by mosquitofish downstream.

ASSOCIATED SPECIES

Big Bend gambusia have been found associated with at least five other fish species within their native range. These included, at Spring 4, two minnows (Notropis braytoni and N. lutrensis), another poeciliid (Gambusia affinis), an ictalurid (presumably Ictalurus punctatus) and a centrarchid (Lepomis cyanellus). The channel catfish and green sunfish (potential predators) were reported to have been purposefully stocked into the overflow pool of Spring 4; perhaps the other species accidentally were placed into the pool along with these game species (Hubbs and Springer 1957, Hubbs and Broderick 1963). These predators were removed and their impacts reportedly were minimal (Hubbe and Echelle 1972). The two potentially competitive minnows also were eliminated, but the mosquitofish survived and apparently is a serious competitive and predatory threat to Big Bend gambusia. A second introduction of green sunfish occurred in 1968, apparently as an accident by campers who wished to "help the conservation program" (Hubbs and Echelle 1972). These also were eliminated with few noticeable effects on the Big Bend gambusia. At the present time, no fishes are known to coexist with Big Bend gambusia.

A [illegible] 18 [illegible] R[illegible] G[illegible] B[illegible] B[illegible] gambusia (H[illegible] . 1977[illegible]) [illegible] B[illegible] B[illegible] . T[illegible] move[illegible] [illegible] -[illegible].

O[illegible] B[illegible] B[illegible] items[illegible] G. gaigei,[illegible] saltcedars,[illegible]/[illegible].

REPRODUCTION

T[illegible] Big B[illegible] (1963)[illegible] 40[illegible]. T[illegible] D[illegible] N[illegible] F[illegible] H[illegible]. O[illegible] known[illegible]. H[illegible] months,[illegible] interbrood[illegible] 1-2 months. T[illegible] G[illegible]. F[illegible] poeciliids.

COMPETITION

T[illegible] competition[illegible] G.[illegible]

the survival of Big Bend gambusia populations is primarily circumstantial. Other factors such as predation on young may be involved (Meffe 1983). Also, Gambusia gaigei does not flourish in the presence of Gambusia affinis (Hubbs et al., 1977a). The recorded evidence of this includes: (1) the replacement of Gambusia gaigei by Gambusia affinis in the Spring 4 outflow (1954-56); (2) replacement of Gambusia gaigei by Gambusia affinis in the first refugium (Fig 2; 1960-1961); (3) the failure of reintroduced Gambusia gaigei to establish a population in Boquillas Spring where Gambusia affinis now thrive; (4) the rapid replacement of Gambusia gaigei by Gambusia affinis in artificial pools near Brownsville. This last example included disappearance of mature Gambusia gaigei within 3 months of the first appearance of Gambusia affinis suggesting that competition or predation on adults as well as the young. In general, the rates of replacement were most rapid in eurythermal habitats (fluctuating temperatures) and slowest in warm, springrun habitats (constant temperatures).

DEVELOPMENT

Visitors to Big Bend National Park continue to increase with coincidental impacts on the park's natural resources. In the future, satisfaction of additional visitor needs will require careful planning to avoid overburdening the Rio Grande Village area with new demands for water and space. Current visitor use of the Rio Grande Village area may be approaching the maximum commensurate with management for survival

of the Big Bend gambusia, with the main threat being increased pressure on the park to provide additional facilities. Water supply for Rio Grande Village presently is pumped from Spring 4, utilizing most of the natural flow from this spring.

RECHARGE ZONE

Spring 1 and Spring 4 are important for sustaining Gambusia gaigei in the Rio Grande Village area of Big Bend National Park. These springs (about 270 meters apart) have been developed, altering their natural flows. Chemical water analyses show them to have been almost identical during the past 24 years and strongly suggest that both springs have a common source. Springs 1 and 4 are intermediate thermal springs, part of a cluster of six known thermal springs concentrated in this area of the Big Bend of the Rio Grande. Temperatures of the spring cluster are in the 30-50°C range with the warmest temperatures in Hot Springs and temperatures in Springs 1 and 4 near 34°C. The points of issue of Springs 1 and 4 are located along the contact of the upthrow side of the Santa Elena Limestone of Cretaceous Age (Moore 1980).

Thermal water issuing from both springs is of ancient origin with the principal recharge zone located in higher elevations of the Sierra del Carmen (Moore 1980). The fault system, formed in Mesozoic times during development of the Sierra del Carmen, serves both as a means for collecting and recharging the groundwater system as well

as an avenue by which groundwaters are discharged in a spring line. In addition to the concentrated flows of Springs 1 and 4, diffused seepage occurs in the vicinity.

No land—use changes or significant water developments are anticipated over the recharge zone; however, monitoring of Spring 1 and Spring 4 discharges should continue so that potential changes in water quality or quantity are detected as early as possible.

RUNOFF

Surface runoff and Rio Grande flooding are two continual threats to the existence of Gambusia gaigei. Periods of unusually high precipitation could result in surface runoff causing significant silt deposition and/or erosion in both the refugium and/or springruns. Flooding or broad surface runoff could provide an avenue for invasion of Gambusia gaigei habitats by Gambusia affinis (or other undesirable species) and renew the threat of biological contamination. The greater of the two threats is flooding by the Rio Grande. Flow in the Rio Grande near Big Bend is regulated primarily by water released from Presa Luis L. Leon into the Rio Conchos in Mexico. Cooperative efforts should be maintained with the Republic of Mexico to prevent water releases large enough to flood Rio Grande Village. However, high rainfall and seasonal runoff in the Rio Grande are not predictable nor fully controllable and could result in flooding of Gambusia gaigei habitat.

HABITAT MODIFICATIONS

The history of spring visitation by scientists interested in observing and collecting Big Bend gambusia is sketchy and has led to considerable discussion about which spring is the type locality and which springs were once occupied by the species. This is covered in detail by Hubbs et al. (1977a).

Available evidence is that the type locality (Boquillas Spring) dried during the 1950s. Although flows have now resumed, the waters are occupied by dense populations of Gambusia affinis. Thus, in its present condition, the type locality is no longer a favorable habitat for Big Bend gambusia. The other actual or potential habitats for Big Bend gambusia are the outflows of Spring 1 and Spring 4.

Spring 4 originally flowed almost due west about 20 meters and then southwest for about 80 meters to a conjunction with runoff draining the northeast side of the Rio Grande Village valley (Fig. 2). The joined streams flowed about 200 meters south to the Rio Grande. In 1951, the flow was diverted by a dike so that it flowed directly south into a large overflow pool. This pool is now a choked, cattail slough; excess water flows south to join the old channel just prior to entry into the Rio Grande. Presently, some water flows through both courses; the original flow passes through a wooded grove until it crosses the nature trail. Beyond that point, it enters another cattail slough associated with a beaver pond. The diverted part of the stream is filled with cattails

until it crosses the nature trail (the trail occupies the crest of the dam forming the overflow pool). Most of the water frcm Spring 4 is used as a water supply for Rio Grande Village.

Little is known concerning the early history of Spring 1. Early maps suggest an outflow to the east toward Berkeley House. Other changes in the area are discussed under conservation efforts.

CONSERVATION EFFORTS

Over the years, there have been projects designed to modify spring outflows through ditches and ponds to enhance the appearance of the oasis image" of the Rio Grande Village area. Since the 1950s, these projects have been cognizant of Big Bend gambusia requirements.

Chief conservation efforts have been to ensure the su::vival of the Spring 4 population. The various problem are treated in Hu bs and Broderick (1963), Wauer (1973), Hubbs et al. (1977a), Hubbs and Williams (1979). The initial difficulties occurred in 1954 through 195) when Gambusia affinis was observed to be replacing Big Bend gambusia in Spring 4. The October 9, 1956, renovation involved an unsuccessful effort to eradicate Gambusia affinis from Spring 4. On that date, live B .g Bend gambusia were removed from the Spring 4 outflow. Subsets of t e live sample were

introduced into potentially suitable Park Service waters. All of these fish died; the only remaining living individuals were three fish maintained in Austin and returned to the park the following spring (1957). These fish were stocked into the first refugium pond built during the 1956-57 winter. Subsequently, Gambusia affinis were noted to be abundant in the refugium pond. On April 16, 1960, 15 Big Bend gambusia were removed from the initial refugium and taken to Austin. During the summer, the current refugium near Spring 1 was constructed and filled with Spring 4 water. Twenty fish were placed in this refugium August 7, 1960.

During 1968, green sunfish were unexpectedly observed in the new refugium pond and these predators were eliminated.

A massive mortality of Big Bend gambusia in the refugium was noted in December 1975. The observations are in accord with cold shock lethality (Hubbs and Williams 1979). In August 1976, the few remaining fish in the refugium were supplemented by descendents of the 1960 stocks that had been maintained in Austin.

In late 1976, a constant flow-through system based on pumped water from Spring 1 was established in the refugium. This system was designed to mitigate the effects of thermal extremes such as those that presumably caused the December 1975 mortality. Overflow water drained to the south and into a saltcedar/cattail thicket. The overflow water was concentrated in an overflow ditch (Fig. 3). In January 1978, Big Bend gambusia from

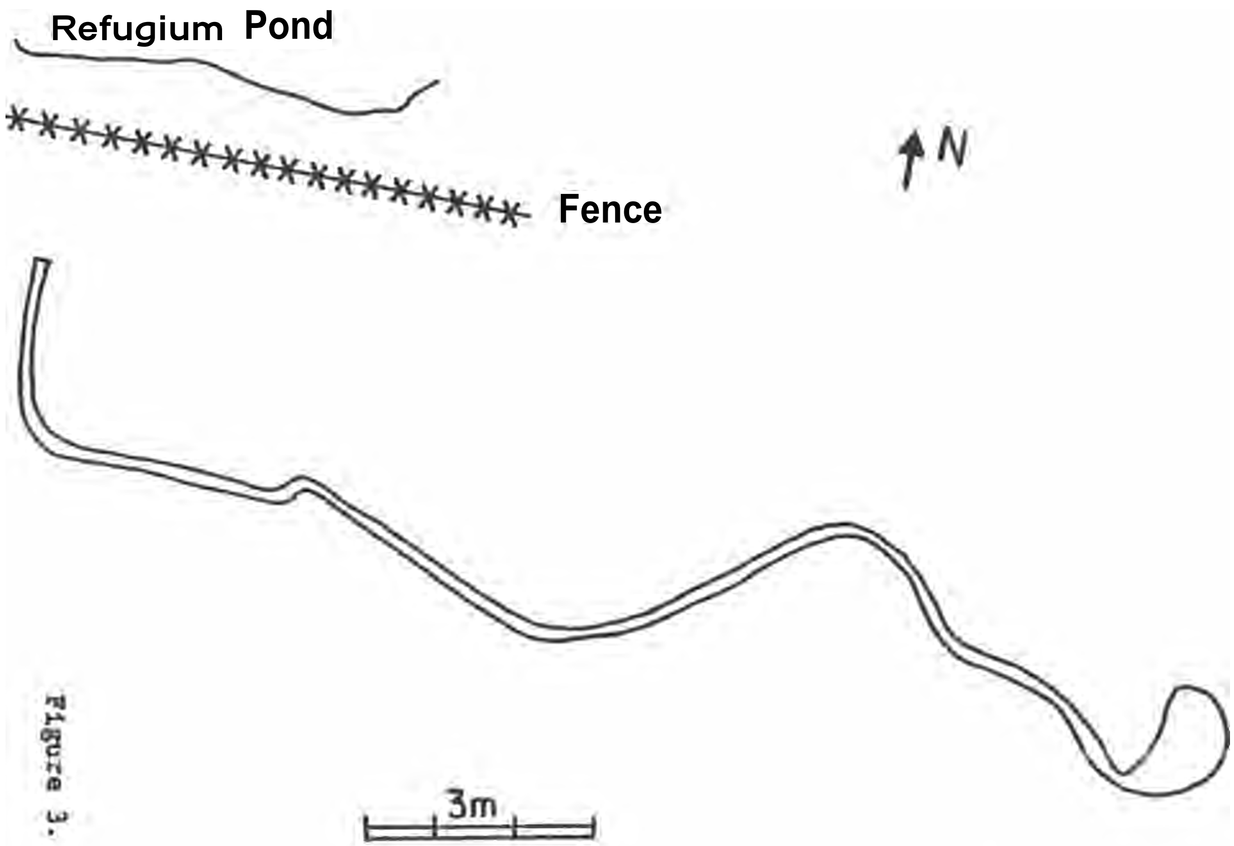

Figure 3. Overflow ditch of Big Bend gambusia refugium pond.

the refugium were placed in the overflow drainage ditch and they now flourish in the refugium and in its drainage ditch.

A stock of Big Bend gambusia was first taken to Dexter National Fish Hatchery in 1974. Low winter temperatures eliminated several stockings at Dexter, but present procedures call for maintaining some fish in warmer hatch-house waters throughout the winter. This change has allowed the present population to survive since 1981, and guarantees replacement of Big Bend gambusia in the event of a massive mortality of the species in Big Bend National Park.

Future management goals for recovery of the species include the supplement of spring flows from wells, extending the outflow from Spring 1 to form a slow, shaded creek, redirecting the flow from Spring 4 to form a stream which will approximate predevelopment conditions, eradication of G. affinis from the campground area, and the establishment of Big Bend gambusia in other suitable locations.

PART II

RECOVERY

Objective

The ultimate goal of this recovery plan is to secure survival of the Big Bend gambusia in a natural setting. This goal should result from implementation of the recovery plan proposed below. because of the extremely limited distribution and tenuous habitat conditions, Big Bend gambusia may never be downlisted or at least delisted.

Step-Down Outline

Primary goal: Assure the survival of the Big Bend gambusia (Gambusia gaigei) through improvement of its status.

1.0 Maintain and enhance the existing Big Bend gambusia population and its habitat.

1.1 Identify population needs.

1.11 Competition with Gambusia affinis

1.12 Prey species biology

1.13 Reproductive variables

1.14 Predation

1.15 Surviorship

1.16 Diseases and parasites

1.17 Habitat requirements

1.2 Monitor existing population and habitat.

1.3 Evaluate, maintain, and enhance habitat.

1.31 Supplement spring flow

1.32 Manage Spring 1

1.33 Manage Spring 4

1.34 Irrigate campground from a well

1.35 Eradicate Gambusia affinis from campground area

1.36 Minimize campground impact

2.0 Establish Big Bend gambusia in suitable locations.

2.1 Determine suitable locations

2.2 Stock Big Bend gambusia in Spring 4

2.3 Use Big Bend gambusia for mosquito control in the Big Bend area

2.4 Monitor released populations

2.5 Manage introduced populations

3.0 Maintain a captive population of Big Bend gambusia.

4.0 Produce information for public consumption.

4.1 Information phamplet

4.2 Interpretive programs

4.3 News releases

5.0 Enforce Federal and State laws.

5.1 Status

5.2 Habitat integrity

Narrative

Recovery Goal: Assure the survival of the Big Bend gambusia (Gambusia gaigei) through improvement of its status.

1.0 Maintain and enhance the existin Bi Bend ambusia sopulation and *Its* habitat.

The only known natural population of Big Bend gambusia inhabits a refugium in Big Bend National Park. The recovery team recommends that the first priority for recovery of the species be enhancement of suitable habitat. Unless the environment is appropriately modified to assure continuity, survival of the species remains under continued threat. In addition, the exceedingly small geographic range is of great concern because on seemingly minor environmental change could exterminate the species from the wild.

1.1 Identify population needs

It is essential to understand the biology and ecology of Big Bend gambusia. In the event the status of the species declines, causative factors can be identified and remedied as quickly as possible.

1.11 Assess potential for competition with Gambusia affinis. Gambusia affinis is a known and continuing potential competitor with G. gaigei. It is essential to understand competitive interactions between Big Bend gambusia and G. affinis because of the serious and persistent threat the latter species poses to the former. Studies should be conducted to better understand the competitive interactions for food and space between these two species. Contrast the biological requirements of each species whereever appropriate.

1.12 Determine food preferences and prey biology.

Inventory the prey species present in the ref ugium and in potential restoration sites. In addition, conduct studies to determine food preferences of Big Bend gambusia and seasonal food availability.

1.13 Determine reproductive variables of Big Bend gambusia.

Additional knowledge of the reproductive biology (reproductive season, fecundity, interbrood interval) of the species is not urgent to this recovery plan but studies should be pursued wherever possible to develop a reproductive data base useful to enhance perpetuation of the species.

1.14 Determine effects of predation.

Lepomis cyanellus has been linked to a decline of Big Bend gambusia during the 1960s. Determine effects of predation by potential predators (birds, sunfish, etc.). This study should involve selectivity on Big Bend gambusia by predators.

1.15 Determine survivorship by age groups.

Little is known about survivorship curves for Big Bend gambusia. Mortality rates for each life history stage should be determined and that information incorporated into a plan for reducing mortality.

1.16 Determine diseases and parasites.

No data are available on the diseases and parasites affecting Big Bend gambusia. As the species occupies limited space, an epidemic could seriously impact chances of survival. Advance knowledge of the diseases and parasites of Big Bend gambusia could be of assistance in containing an epidemic.

1.17 Determine habitat requirements.

Valuable insight for protection and enhancement of Big Bend gambusia would be gained from a study of seasonally varying habitat associations including physical, chemical, and biotic elements of present habitat and potential restoration sites.

Develop an adequate and dependable water source to satisfy the basic habitat requirement of Big Bend gambusia. Diminished spring outflows have resulted in loss of some of the original Big Bend gambusia habitat. The human demand for water in the park is likely to exacerbate the problem. Spring flows in the refygium and potential restoration sites must be enhanced.

1.2 Monitor Big Bend gambusia and its habitat.

Conduct long term population and monitoring studies of Big Bend gambusia focusing interests on habitat conditions, population numbers, condition, and age structure of fish. Should any of these or other factors suggest decline in the population or degradation of habitat, causative factors must be identified and corrected. Every proposed activity which might adversely affect the Big Bend gambusia or its habitat must be critically reviewed.

1.3 Evaluate, maintain, and enhance habitat.

Big Bend gambusia survivorship is dependent upon availability of a warm spring habitat. The species survives well in other habitats only in the absence of G. affinis; but the adverse effect of G. affinis is least important in warm springrun environments.

1.31 Supplement spring flow.

The two major warm springs within the historic range (Springs 1 and 4) have adequate available outflow volumes for stable Big Bend gambusia populations. The ground water in the vicinity of the Rio Grande Village Campground emerges at several locations. Wells should be dug into the aquifer upstream from the outflows of Springs 1 and 4. Water from these wells should be available to supplement the flows from Springs 1 and/or 4 when either flow is diminished. Each spring (see 1.32 and 1.33 below) should have consistent flow to maximize the stenothermal warm environment most optimal for Gambusia gaigei populations. Flow rate is less critical than maintenance of stenothermal conditions typical of springrun habitats.

1.32 Manage Spring 1.

Spring 1 is used to provide water for the existing refugium. The outflow from the pool now drains into a saltcedar/cattail thicket. This outflow should be extended along the present asphalt road in the form of a slow, shaded creek. No water should be permitted to reach the Rio Grande. It should be dispersed on flatlands in the vicinity of the maintenance yard. The vegetation developing along the slow creek should be monitored carefully. Cattails and bullrushes should be removed to preclude overgrowth. Appropriate native shade trees should be encouraged.

1.33 Manage Spring 4.

The outflow from Spring 4 contained the ancestors of the present stocks of Big Bend gambusia, and some individuals may still exist in the dense vegetation. Excess water not needed for the fish could be used for domestic use in the campground, but priority should be placed on habitat for the endangered species. All water for fish use should be directed into the original channel. Redirection of flow can be achieved by removal of a portion of the existing dike blocking flow towards the old channel and placing dirt across the ditch carrying water to the overflow pool. Concentration of the water in the channel that flows across the nature trail will recreate a stream that approximates presumed predevelopment circumstances.

The flow in the combined stream should follow the natural stream course. The stream should have a consistent flow with minimal shallow, still water; however, the flow should not be directed through a straight channel. Factors that might cause ponding of the stream (beaver activities, cattail growth, etc.) should be prevented.

1.34 Irrigate the campground from a well.

The present practice of using water directly pumped from the Rio Grande to water vegetation in Rio Grande Village should be discontinued to avoid contamination with G. affinis. A shallow well should be dug into the river gravel in a secure location at least 50 meters from the river bank. This well (or wells) should be the source of irrigation water for the campground.

1.35 Eradicate Gambusia affinis from campground area.

Any population of Gambusia affinis near waters inhabited by Gambusia gaigei is a potential source of an introduction; thus, all likely sources of contamination should be removed. Populations of G. affinis exist in most exposed open water in the vicinity of Rio Grande Village. Those populations should be eliminated. Many of the populations can be eliminated by drying of the pools. Use of irrigation

water (from the well(s) described in 1.34) should be monitored carefully so water does not accumulate in low spots. Such inadvertant pooling should be allowed to dry so that a crust forms across the bottom; however, subsequent to complete drying, overflow water may be allowed to accumulate in these ponds. When G. affinis has been eradicated from all ponds in and adjacent to the campground, the only sources of potential contamination will be populations in the Rio Grande and in the outflow from Spring 4. It is not feasible to eradicate G. affinis from the Rio Grande and past attempts in Spring 4 have been unsuccessful; however, any activities that enhance G. affinis abundance in either area should be avoided.

1.36 Minimize campground impact

Any activities at the Rio Grande Village Campground that adversely impact Big Bend gambusia must be avoided. Campsites close to Sping 1 or 4 outflows will be reevaluated. Nearby campsites should be closed and new or replacement campsites be located a greater distance from the springruns or sources. Alternate camping localities elsewhere in the park should be considered to protect Gambusia gaigei habitat.

2.0 Establish Big Bend gambusia in suitable locations.

Only warm spring habitats within the Boquillas Spring – Rio Grande Village area (Figure 1) are suitable for introduction of Big Bend gambusia.

Purposes of this action are to: (1) increase the numbers of viable stocks within the historic range of the species; (2) provide transplantation experiments in a variety of situations and thereby gain increased understanding of the breadth of conditions tolerated by the species; (3) provide situations where genetic/ecological interactions with G. affinis can be examined in natural conditions; and (4) reduce the size of the resident G. affinis population, thereby reducing the threat to G. gaigei.

In the long run, G. affinis will be a persistent component of the local fauna with which G. gaigei must contend. The consequences of interaction between the two species must be understood.

2.1 Determine suitable locations to stock Big Bend gambusia

Spring 4 is the only warm spring habitat currently suitable for G. gaigei, however, ponds in the campground may also be suitable.

2.2 Stock Big Bend gambusia in Spring 4

Once actions described in 1.33 have been implemented, Big Bend gambusia should be transported from Spring 1 [illegible]ugium to the [illegible] portion of the Spring 4 run. Transplantation of at least 100 females and 100 males is recommended. Repeated efforts should be made if initial introduction(s) are unsuccessful.

Spring 4 should provide a valuable opportunity to examine resource utilization differences and genetic interaction between G. gaigei and G. affinis.

2.3 Use Big Bend gambusia for mosquito control in Big Bend area.

At present the park maintains a large pool which receives overflow irrigation water from the campground area (Figure 1). This pool represents a large reservoir of G. affinis which is a threat to the well being of Big Bend gambusia. This pool should be stocked with Gambusia gaigei after implementation of 1.35.

2.4 Monitor relocated populations of Big Bend gambusia.

To assess the success of transplantations and other management actions, all known populations at Big Bend should be sampled at least twice annually. Such monitoring should be coupled with assessments of habitat quality.

2.41 Establish monitoring procedures and schedules

Sample all sites twice a year, in February and August. Extreme care should be taken to guard against inadvertent transport of eggs/embryos of G. affinis and other fishes. The procedures for sampling is appended to this plan.

2.411 Present ref ugium should sample, preserve, and catalogue at least 15 specimens, unless such sample represents more than 1 percent of the standing populations numbers.

2.412 Similar sampling in the overflow stream from Spring 4 done by sources selected by the National Park Servive in consultation with the Fish and Wildlife Service.

2.42 Establish emergency response procedures

When routine monitoring reveals a degradation of the status of Big Bend gambusia or habitat, procedures for assuring survival of the species should be developed and ready to be put into affect.

2.5 Manage introduced populations

3.0 Maintain a Captive Population of Big Bend Gambusia

Big Bend gambusia should be maintained at Dexter National Fish Hatchery to provide a reserve gene pool in the event that the species experiences a severe population decline in its natural setting. Standard procedures at the hatchery should be followed. This facility has the capability to safely overwinter G. gaigei and to isolate the species from other gambusine fishes. The captive populations can be used to provide research specimens (both live and preserved) to agencies and institutions conducting research on G. gaigei. If needed, designated studies can also be carried out at the holding facility. The stock at Dexter should be checked annually to verify the genetic integrity of the captive population.

4.0 Information Base

Funds and manpower should be expended to provide public information on survival problems and recovery efforts relevant to Gambusia gaigei in Big Bend National Park.

4.1 I

I , , , requirements B B .

4.2 I P

I park programs .

4.3 N R

N B B .

5.0 L E

T B B . I B B N P . N P S enforcement . S F enforcement N P S

should be provided information relevant to Big Bend gambusia identification, legal status, distribution and maintenance. Habitat integrity should be emphasized to avert actions (intentional or unintentional) or projects that would be deleterious.

5.1 Status

Enforcement agencies (Federal and State) will be kept advised of the legal status of the Big Bend gambusia and its habitat according to State and Federal laws so they may properly identify the species and be aware of the potential threats and hazards to its continued existence.

5.2 Habitat integrity.

Agencies with jurisdiction over project activities which could modify the existing habitat in any way should be kept informed of the status of the Big Bend gambusia, its distribution and needs. Section 7 consultation requirements mandate that Federal project specifications preclude any adverse effect on listed species. Protection of the species is a joint responsibility of the U.S. Fish and Wildlife Service, the National Park Service, the State of Texas, and to an extent, the Republic of Mexico.

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PART III

IMPLEMENTATION SCHEDULE

The table that follows is a summary of scheduled actions and costs for the Big Ben Gambusia Recovery Plan. This table indicates the priority in scheduling tasks to meet the objectives, which agencies are responsible for these tasks, a timetable for accomplishing them, and their estimated costs. Implementating Part III is the action of the recovery plan that, when accomplished, will satisfy the prime objective.

GENERAL CATEGORIES FOR IMPLEMENTATION SCHEDULES

Information Gathering - I or R (Research)

1. Population status
2. Habitat status
3. Habitat requirements
4. Management techniques
5. Taxonomic studies
6. Demographic studies
7. Propagation
8. Migration
9. Predation
10. Competition
11. Disease
12. Environmental contaminant
13. Reintroduction
14. Other information

Acquisition - A

1. Lease
2. Easement
3. Management agreement
4. Exchange
5. Withdrawal
6. Fee title
7. Other

Management - M

1. Propagation
2. Reintroduction
3. Habitat maintenance and manipulation
4. Predator and competitor control
5. Depredation control
6. Disease
7. Other management

Other - O

1. Information and education
2. Law enforcement
3. Regulations
4. Administration

Task Priority

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly.

Priority 2 - An action that must be taken to prevent a significant decline in species population habitat quality or some other significant negative impact short of extinction.

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

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 * FY85 (8)	FISCAL YEAR COSTS * (EST.) FY86	FISCAL YEAR COSTS * (EST.) FY87	COMMENTS (9)
R10 R11 R9 R6 R3	Identify population needs	1.1	1	3 years	2	FR RES	NPS	10,000	10,000	10,000	Consist of subtasks 1.11 through 1.17
I1 and 12	Monitor populations and habitat	1.1	2	ongoing	2	SE	NPS	1,000	1,000	1,000	
M3	Supplement spring flow	1.31	2	1 year	2	SE	NPS	25,000			
M3	Manage springs 1 and 4	1.32 1.33	2	ongoing	2	SE	NPS	-	-	-	
M3	Provide water to the campground from a well	1.34	3	1 year	2		NPS	-	-	-	
M4	Eradicatre G. affinis from campground area	1.35	3	1 year	2	FR SE	NPS TP&W	2,000			
M3	Minimize campground impact	1.36	3	2 years	2	SE	NPS	-	-	-	
M2	Determine suitable stocking locations	2.1	3	1 year	2	SE	NPS TP&W	2,000			
M2	Stock Big Bend Gabmusia	2.2	3	ongoing as necessary	2	SE	NPS TP&W	-	-	-	
M7	Control mosquitos with Big Bend Gambusia	2.3	3	ongoing	2	SE	NPS	-	-	-	

*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 ODSTS (EST.)* FY85 (8)	FY86	FY87	COMMENTS (9)
M2	Monitor relocated populations	2.4	3	ongoing	2	SE	NPS	see cost associated with Task 1.2			
M1	Maintain a captive population	3.0	2	ongoing	2	SE FR		5,000	5,000	5,000	
01	Prepare a information pamphlet	4.1	3	1 year	2	SE	NPS	3,000	–	–	
01	Conduct interpretive programs	4.2	3	ongoing	2	SE	NPS	–	–	–	
02	Enforce all laws to protect the species	5	3	ongoing	2	LE	NPS	5,000	5,000	5,000	

* Cost refer to USFWS expenditures only

PART IV - APPENDIX

APPENDIX I

Replies to Comments

A-1 Recovery plan changed to put water needs of Big Bend gambusia ahead of campground domestic water use.

A-2 Agreed and Recovery Plan changed accordingly.

A-3 The Preface section of the recovery plan was transferred to the Disclaimer section and NPS added.

A-4 Corrected.

A-5 The paragraph was not changed since it adequately describes the taxonomic status of the species.

A-6 Rewritten.

A-7 Corrected.

A-8 Sentence was rewritten.

A-9 Corrected.

A-10 Changed.

A-11 Changed as suggested.

A-12 Changed as suggested.

A-13 A short discussion of threats has been included.

A-14 The Literature Cited section was changed to Miller (1978).

A-15 The Recovery Team discussed the wording of the Taxonomic section of the recovery plan and decided that the section should remain as written because it is more accurate. Some changes for clarity have been added.

A-16 Changed as suggested.

A-17 Map changed as suggested.

A-18 Discussion of future management goals added.

A-19 The discussion of the primary objective was rewritten to expand upon recovery goals and habitat limitations.

A-20 Added as suggested.

A-21 Some generic information has been gained about G. affinis competition with Gila topminnows (Paeciliopsis occidentalis). That data has already been incorporated in this plan, but a great deal of specific knowledge is still lacking.

A-22 Discussion added concerning potential for exotic fish introduction if pumping from the river occurs.

A-23 Number is unknown at present. Investigation of potentials in various springs will have to be accomplished.

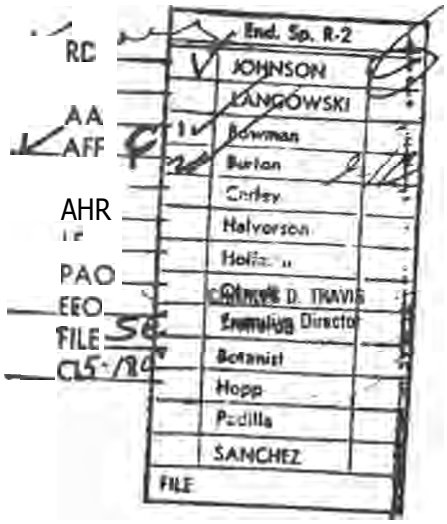
A-24 Changed.

A-25 Changed accordingly.

A-26 The Implementation Schedule has been rewritten as suggested.

A-27 Changed as suggested.

TEXAS
PARKS AND WILDLIFE DEPARTMENT
4200 Smith School Road Austin, Texas 78744



May 18, 1984

Mr. Michael J. Spear
Director, Region 2
U. S. Fish and Wildlife Service
P. 0. Box 1306
Albuquerque, New Mexico 87103

Dear Mike:

This is in response to your letter of March 29, 1984 regarding the agency review draft recovery plan for the Big Bend gambusia.

Overall, the recovery plan embodies strategies which, when implemented, should ensure survival of the species. The plan should succeed although, in view of the restricted distribution and problems for survival continually facing this species, recovery to the point of delisting or downlisting does not appear likely.

Our comments have been incorporated into the returned draft. Many of them relate to minor typographical errors, but two warrant additional discussion here.

A-1 Recovery Outline Narrative 1.33 places the needs of campground domestic water above the needs of the Big Bend gambusia. It would seem appropriate in a fish species recovery plan that the needs of people would be subordinate. Another source of water for people should be sought--perhaps purified Rio Grande water.

A-2 In 2.32, reference is made to recovery team approved actions. Shouldn't this be recommended actions?

Thank you for the opportunity to comment on this matter.

Sincerely,

Charles D. Travis
Executive Director

CDT:FEP:aeh

Enclosure

United States Department of the Interior

NATIONAL PARK SERVICE

Big Bend National Park
Big Bend National Park, Texas 79834

IN REPLY REFER TO:

N1621

May 14, 1984

Memorandum

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

From: Superintendent, Big Bend National Park

Subject: Agency Review Draft Recovery Plan for Big Bend Gambusia, (Gambusia gaigei Hubbs 1929)

Our comments on the Draft Recovery Plan are as follows:

A-3 1. Preface, paragraph 3, last sentence - Omit Texas Parks and Wildlife Department and insert National Park Service.

A-4 2. Page 1, Part I, Introduction, second paragraph, fourth line - Omit see.

A-5 3. Page 1, Part I, Taxonomic Status - This paragraph needs clarification.

A-6 4. Page 2, Part I, Distribution and Description of Habitat, first paragraph, first sentence - This sentence should read: The Big Bend Gambusia is known only from spring habitats in the vicinity of Boquillas crossing and Rio Grande Village in Big Bend National Park.

A-7 5. Figure 2 - The Barkley Cabin is misspelled. Berkeley is the correct spelling.

A-8 6. Page 6, # 2, Development, second sentence - Omit one "in the future."

A-9 7. Page 10, paragraph 2, second line - Barkley House is misspelled. Berkeley is the correct spelling.

We appreciate the opportunity to comment on the Draft Recovery Plan.

H. Gilbert Lusk

United States Department of the Interior

FISH AND WILDLIFE SERVICE
WASHINGTON, D.C. 20240

ADDRESS ONLY THE DIRECTOR. FISH AND WILDLIFE SERVICE

In Reply Refer To:
FWS/OES

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NGOWSKI
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Cailey
Helvorson
Hoffman
Olivell
Botanist
SANCHEZ
FILE

Memorandum

To: Regional Director, Region 2 (ARD/AFF)

From: Director

Subject: Big Bend Gambusia Recovery Plan - Agency Review Draft

Attached is a copy of the subject plan with numerous editorial and substantive comments indicated in the margins. The majority of these items were brought to your attention in the Technical Review Draft. Please pay close attention to the comments noted on pages 2, 3, 6, 11, 13, 15, 17, 18, and 21 of the attached plan. Some of the more substantive comments are reiterated below:

A-10 1. Title page: The title page should include only the title, publisher, Director's signature line, and the date.

A-11 2. Disclaimer page: Refer to the Recovery Planning Guidelines for the format of the Disclaimer page. A Disclaimer page should immediately follow the title page. The disclaimer paragraph used in the Preface (page i, paragraph 4) should begin the Disclaimer page. The proper acknowledgement for the plan should be indicated as follows:

> The Big Bend Gambusia Recovery Plan, dated ____________ prepared by the U.S. Fish and Wildlife Service in cooperation with the Rio Grande Fishes Recovery Team.

The list of team members and consultants should be included on the Disclaimer page. Also, the Disclaimer page should identify the source of additional copies:

> Fish and Wildlife Reference Service
> 1776 E. Jefferson Street, 4th Floor
> Rockville, Maryland 20852
> 301/468-1737, ext. 231, or
> Toll Free 1-800-582-3421

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A-12 3. The Table of Contents should follow the Disclaimer page. To be consistent with other plans, the headings for the parts of the plan should be changed to: Part I - Introduction; Part II - Recovery; Part III - Implementation Schedule; Part TV - Appendix.

R'CD
FWS-Reg
JUN 7
AFF.

The Literature Cited section should be the last section of Part II and immediately precede Part III - Implementation Schedule. The Objective should be identifed in the Table of Contents.

A-13 4. Page 1, Introduction: The introduction should include a brief discussion of the threats to the Gambusia gaigei.

A-14 5. Page 1, Taxonomic Status: The reference to Miller (1978) is listed as Miller (1977) in the Literature Cited section.

A-15 6. Page 1, Taxonomic Status: The first two sentences are confusing. We suggest the following rewrite:

> The Big Bend gambusia was described by Hubbs (1929). Although there has been some disagreement (Rosen and Bailey, 1966) regarding the synonomy of the species, the concensus is that Gambusia gaigei is a valid species (Rivas, 1966; Peden, 1973; Alvarez, 1970; Miller, 1977).

A-16 7. Page 1, Taxonomic Status: This paragraph should be divided into two paragraphs: one on the synonomy discussion and another on the relationship of G. gaigei to the G. senilis species group.

A-17 8. Figure 1: The map would convey more information if the locations of present and extinct populations were labeled.

A-18 9. Page 12: To complete the management scenario, briefly discuss future management goals.

A-1910. Page 15, Part II: The discussion of the primary objective should include quantifiable goals with regard to the habitat and the species. Logically, the goals should correspond to the factors for which the Big Bend gambusia was listed.

If it appears likely the species cannot be reclassified or delisted, this should be clearly stated and the quantified goal for maintaining or preventing extinction of the species should be stated.

A-20 11. Page 15, Stepdown Outline: Add the following subtasks under Task 2.0:

> 2.1 Determine suitable locations
> 2.5 Manage introduced populations

A-21 12. Page 17, Task 1.11: Since competition with G. affinis is a problem for most small listed fishes in Region 2, could this be studied on a more general basis and the data applied to more than one species?

A-22 13. Page 20, Task 1.34: Please add some discussion on the necessity of this task. What will be enhanced by the accomplishment of this task?

A-23 14. Page 21, Task 2.0: Approximately how many potential sites exist for reintroduction?

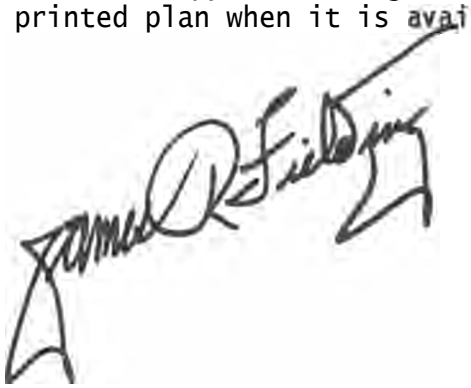
15. Page 24, Appendix: Refer to the Recovery Planning Guidelines. The Appendix should be moved to the end of the plan, with a title page immediately preceding it.

A-25 16. Implementation Schedule: Refer to the Recovery Planning Guidelines. Include a title page for the Implementation Schedule. The title page should include the definitions for the task priorities, general implementation categories, and abbreviations. Attached are examples from another plan.

A-26 17. Implementation Schedule: The Implementation Schedule is not acceptable. Recovery tasks should be identified as specifically as possible because this schedule will become the key for all Service activities (including funding recovery actions) involved in the recovery of the species. As you know, the review of permit proposals, Section 7 consultations, unsolicited proposals, State Federal Aid proposals, and all other funding requests will be examined against the recovery plan and corresponding Implementation Schedule. Subtasks must be included if the Implementation Schedule is to be useful.

A-27 18. Implementation Schedule: Task 1.0 should be priority 1.

We hope these comments will be helpful in preparing the final draft. If you feel that any of these comments do not warrant revision of this draft, please provide your rationale, via return memorandum, prior to the Regional Director's approval. Upon approval, please send a copy of the signature page. Also, please send 30 copies of the printed plan when it is available.



Attachments

APPENDIX II

Monitoring Procedures

Sampling should be done biannually (February and August) with 3-mm mesh seines; 3-meters long (pond) and 1.5-meters long (stream). Five seine hauls should be made at roughly equidistant points around the perimeter of the refugium pond. Each haul should begin 3-5 meters offshore and extend to the shore. Two seine hauls should be made in the pond outlet stream, one haul near the pond outlet, the other near the terminus. These hauls should be 2-3 meters long and should be made in the direction of streamflow. The pond and ditch should be visually examined to ascertain presence of any other species. All seines used should be sun dried before use to preclude introduction of other fishes. Samples of 15 Big Bend gambusia (preferably males) should be preserved from both localities (pond and ditch) in separate labeled jars with 10% formalin. The preserved sample should be obtained from the first seine haul(s). If the fish are scarce, the number preserved may be reduced to avoid depletion of the population. All other fish captured should be visually examined to ensure that no other species are present; of particular concern is the mosquitofish, Gambusia affinis. Because of the difficulty of field separation of Gambusia species, selection of onsite supervisory personnel should be reviewed by the recovery team. The preserved specimens should be stored in an appropriate museum. The park should maintain a written log regarding time when collections were made, personnel involved, and disposition of samples. State and park collecting permits will be acquired before collections are made.