

Southwest Texas State University

San Marcos, Texas 78666

DEPARTMENT OF BIOLOGY

December 13, 1976

Carol D. Justice
Endangered Species Biologist
P. O. Box 1306
U. S. Fish and Wildlife Service
Albuquerque, New Mexico 87103

Dear Carol:

Enclosed are nine copies of the final report for Contract No. 14-16-0002-3685 titled "Investigation of the Status and Distribution of the San Marcos Gambusia (Gambusia georgei) in Texas." When Figure 3 was reduced the symbols were too small so we drew some larger symbols over the small ones. If this or anything else causes you any problems let me know.

Have a Merry Christmas.

Sincerely,

B. G. Whiteside

B. G. Whiteside, Ph.D.
Associate Professor

BGW: dt

copies to:
ES (lab)

OES (WD)

TP+W (Potter)

FS (San Marcos NFH)

Gambusia georgei Hubbs and Peden, 1969

San Marcos gambusia

PHYLUM: Chordata ORDER: Atheriniformes
CLASS: Osteichthyes FAMILY: Poeciliidae
STATUS: Not on the present U. S. Fish and Wildlife
Service's endangered fauna list (I propose that
it be added to the endangered species list; see
Section VIII).

PORTION OF RANGE WHERE ENDANGERED: Entire Range (If added
to the Endangered Species List)

I. Background:

- A. Original Discovery - Hubbs and Peden (1969) originally described this species as Gambusia georgei from specimens collected from the San Marcos River between Rio Vista Dam and the eastern boundary of the San Marcos State Fish Hatchery. They further state that G. georgei has been in the San Marcos area for more than 80 years and is likely to be native. Hubbs and Peden (1969) also discuss the relationship of G. georgei to other gambusiins.
- B. Date First Listed as Threatened - This fish was listed as threatened by the U. S. Fish and Wildlife Service in the 1973 edition of "Threatened Wildlife of the United States." However, the U. S. Fish and Wildlife Service did not include it in their 1974

"United States List of Endangered Fauna." G. georgei is considered as rare by Miller (1972), endangered by Gehlbach (1975), and Hubbs (1976) states that this species requires assistance to avoid extinction.

II. Distinguishing Characteristics:

[The following descriptions of G. georgei were provided by Hubbs and Peden (1969)]

A. General Description -

1. Coloration

- a. Preserved individuals - Strongly cross-hatched by dark pigmentation on margin of scale pockets. Area anterior to anal fin and below eye and pectoral fin pale and not cross-hatched. Area from occiput to snout darker. Weak short dusky bar leading postero-ventrally across cheek from lower border of eye. Lower jaw dusky. Operculum dusky. Darker smudge above base of pectoral fin. Mid-dorsal stripe from occiput to base of dorsal fin. Frequently a very diffuse dusky lateral stripe running posteriorly from above base of pectoral fin. This stripe often dissipates before reaching caudal. A few scattered dark crescent shaped markings on lateral side. A very thin mid-ventral dark line running from anal fin to caudal fin.

Darker pigment usually present near base of dorsal fin. This pigment frequently concentrated into a row of subbasal spots. Pigment often concentrated at fork of each branched dorsal ray to form another row of a few faint spots. Distal margin of dorsal fin with dark pigment. Dorsal and ventral margin of caudal fin with thin line of dark pigment. Caudal fin usually plain. A weak concentration of pigment at proximal fork of each branched caudal ray may form a row of a few faint small spots. Rarely, a large female may have a secondary row of very faint spots at level of secondary fork of each branched ray. Anal fin tends to be dusky with a concentration of pigment on the anterior and distal margins. A concentration of dusky pigment may occur on membrane between basal half of posterior five or six anal fin rays. Gonopodia dusky. Darker pigment in the form of thin crescents on each side of the anal and urogenital opening may be present on a few females.

- b. Live individuals - In life, G. georgei is usually plainly marked. A behaviorally aggressive fish may have a pronounced development of black on the distal margin of the dorsal fin,

on the dusky patch above the pectoral fin, and the black bar on the cheek. This bar can extend itself through dorsal and ventral portions of the usually pale iris. The dark pupil is incorporated into this dark bar. The median fins have a pronounced lemon yellow coloration that provides a ready field identification. In a behaviorally recessive or submissive fish, the above color pattern will disappear and the diffuse dark lateral stripe will develop or become intensified.

I would like to emphasize that Hubbs and Peden's statement about using the yellow color in the median fins as a ready field identification is dependent upon the fish being behaviorally aggressive.

2. Counts - Dorsal fin rays, 6-8 (usually 7); sum of left and right pectoral fin rays, 24-28; scales in lateral series, 29-31 (usually 30); scale rows around caudal peduncle, 16; anal fin rays in females, 9-10 (usually 9).

B. Specific Characters -

1. Measurements (Measurements other than standard length are expressed as thousandths of the standard length)
 - a. Male - standard length, 21.3-29.3 mm; body

depth at origin of dorsal fin, 195-218; dorsal fin origin to tip of lower jaw, 577-606; anal fin origin to tip of lower jaw, 429-476; dorsal fin origin to caudal base, 403-431; anal fin origin to caudal base, 539-577; caudal peduncle depth, 139-158; head length, 245-281; head width, 134-164; snout length, 95-104; orbit length, 75-86; interorbital bony width, 90-112; mouth width 81-98; depressed dorsal fin length, 220-260; gonopodial length, 279-315; caudal fin length, 232-260; pectoral fin length, 184-207; and pelvic fin length, 83-104.

- b. Female - Standard lengths of 31 paratypes range from 25.6 to 39.2 mm. Body depth at origin of dorsal fin, 186-212; dorsal fin origin to tip of lower jaw, 620-642; anal fin origin to tip of lower jaw, 545-574; dorsal fin origin to caudal base, 354-406; anal fin origin to caudal base, 431-478; caudal peduncle depth, 134-150; head length, 237-296; head width, 165-179; snout length, 94-114; orbit length, 74-95; interorbital bony width, 114-133; mouth width, 82-119; depressed dorsal fin length, 205-226; depressed anal fin length, 186-206; caudal fin length, 213-253; pectoral fin length, 184-

204; pelvic fin length, 95-123.

2. Gonopodial characters - The gonopodium is broadly acute (Fig. 1). The third ray is moderately bowed over elbow. Eight to ten antorse slender moderately long spines. Distal spine usually extends to tip of gonopodium. Distal four or five spines with well developed bases. Ray 4a extends almost to distal tip of gonopodium or occasionally exceeds ray 3. Well developed elbow opposite level or proximal 3rd ray spines. This elbow composed of from five to six enlarged segments which are fused together on their anterior surfaces. Elbow greatly thickened so that there is little space between it and the enlarged bases of the spines on ray 3. Distal two or three segments of ray 4a slender and not fused to each other. Proximal segments of elbow opposite distal one or two serrae of ray 4p. Posterior and anterior branches of ray 4 diverge moderately at level near proximal serra and converge distally. Ray 4p a little shorter than ray 4a. Ray 4p with four or five retrorse long slightly curved serrae. Small retrorse claw or hook on posterior branch of ray 4 with short pointed apex. Anterior branch of ray 5 moderately bowed over serrae and terminating in small J-shaped claw.

- C. Sexual Dimorphism - The anal fin of the male is modified into a gonopodium and the anal fin of the female is normal. Also, adult females are usually much larger than adult males.

III. Distribution:

- A. Former Known Distribution - Hubbs and Peden, 1969 report that G. georgei has been collected from the San Marcos River between Rio Vista Dam and the eastern boundary of the San Marcos State Fish Hatchery 500 m on each side of the I-35 bridge, Hays County, Texas (Fig. 2).
- B. Present Known Distribution - The only collection of G. georgei reported since those by Hubbs and Peden (1969) was by Whiteside (1974). The Whiteside collection contained one male specimen taken from the San Marcos River approximately 6 km downstream from the headsprings and approximately 1 km below the out-fall of the new San Marcos Secondary Sewage Treatment Plant (Fig. 2).

During June through November, 1976, gambusiins were collected from many different sites along the entire length of the San Marcos River (Fig. 2 and 3). These collections contained 4,227 Gambusia of which all were microscopically examined and 3,462 were determined to be G. geiseri, 765 were determined to be G. affinis and no specimens of G. georgei were found. The above specimens

were collected from various habitats in the river (for example; from the middle of the stream, backwater areas, under bridges, non-vegetated areas, heavily vegetated areas, etc.) in an attempt to sample all possible habitats that G. georgei might occupy.

G. geiseri were usually found in vegetation away from the stream bank in flowing water. No G. geiseri were collected in the San Marcos River below F.M. 1979 (Fig. 2 and 3). G. affinis were found only in backwater areas and was the only species of Gambusia found in the San Marcos River below F.M. 1979 (Fig. 2 and 3).

The G. georgei specimen reported by Whiteside (1974) represents a range extension when compared to the collections reported by Hubbs and Peden (1969).

- C. How Completely Is The Distribution Known - Considering the amount of sampling that has been done in an attempt to collect G. georgei and that the species is endemic to the San Marcos River, I feel that its distribution is well known.

IV. Habitat:

- A. General Habitat [the following description was provided by Hubbs and Peden (1969)] - G. georgei is essentially restricted to the shallow areas without dense aquatic vegetation in the main San Marcos River where thermal conditions vary little. They inhabit mud bottom areas and are most common under bridges where shade inhibits vegetation. G. georgei never occur abundantly far from the

stream bank or in moderate current.

B. Additional Information About The San Marcos River -

The San Marcos River originates at a series of springs that issue from the Edwards Aquifer within the city limits of San Marcos, Hays County, south-central Texas (Fig. 2). The river flows southeasterly approximately 107 km where it empties into the Guadalupe River about 6 km west of Gonzales, Gonzales County, Texas (Young, et al., 1973) (Fig. 3). Flow from these springs has been dammed forming a 18 hectare lake, known as Spring Lake or Aquarena Springs. This small, clear lake has been commercialized by private interests, offering glass bottom boat rides and underwater stage shows.

San Marcos Springs is one of many fissure springs located along the Balcones Fault Zone. The fault is approximately 282 km long and varies in width from 18 to 48 km, sloping from southwest to northeast (Bernard Johnson Engineers, Inc., 1969). The water temperature of the springs ranges from 21.0 to 22.0 C annually (Schenck, 1975).

The mean discharge of San Marcos Springs during the period 1956-1972 was 4.4 m³/sec (Edwards Bull., 1974). The minimum discharge of 1.3 m³/sec occurred in 1956 and the maximum discharge of 8.5 m³/sec occurred in October 1973. The mean discharge of the springs during the study period, March 1973 through April 1974, was 6.2 m³/sec.

Three creeks, one river, and the effluent of a secondary sewage treatment plant discharge into the river during its first 6.4 km (Fig. 2). Sink Creek, largest of the three creeks, discharges large quantities of runoff from the north into Spring Lake and the Spring Lake dam backs water approximately 1.6 km into Sink Creek. The other two creeks, Willow Springs and Purgatory creeks, are dry except during high rainfall. The Blanco River, a major tributary, empties into the San Marcos River approximately 6.4 km downstream from the headsprings. The effluent of the new San Marcos Secondary Sewage Treatment Plant, built in 1969, empties into the river 4.8 km downstream from the headsprings. The sewage outfall is located approximately 102 river kilometers from the mouth of the river.

- C. Critical Elements - Hubbs and Peden (1969) state that the required habitat for G. georgei in the San Marcos River is rare and that a slight alternation of the river channel could easily exterminate this species. Considering the great amount of sampling for this species that I have done without finding a single specimen it may already be extinct.

V. Nutritional Needs and Feeding Habits:

I know of no information on the food or feeding habits of G. georgei and I am not willing to remove the stomach of the one specimen that I have.

VI. Reproduction:

All *Gambusia* give birth to live young rather than depositing eggs. Fertilization is internal and is accomplished by an intromittent male organ, the gonopodium. The structural details of this organ are used in classification (Fig. 1). In general, gambusiin females are passive in courtship and mate selection (Hubbs and Delco, 1960).

VII. Population Level - Trend and Number:

A. Present natural population level trend and number compared to past years — Many days were spent during 1976 in an attempt to collect specimens of *G. georgei*, without success (See Section III B). Only one specimen of this species has been collected since its original description in 1969 (Whiteside, 1974). Thus, the population must be extremely small or extinct.

Hubbs and Peden (1969) estimated that population of *G. georgei* at fewer than 1,000 individuals at any given time. Considering that Hubbs and Stevenson were able to collect at least 45 specimens on 7 March, 1968 (Hubbs and Peden, 1969) and that I have not been able to collect this species this year, there must have been a considerable decrease in the population size in recent years. One possible explanation for this decrease may have been the severe flooding of the San Marcos River in May 1970.

B. Present Captive Population Level - I could not find anyone who had this species in captivity.

VIII. Reasons For Changing The Status Of The San Marcos Gambusia:

I believe that G. georgei should be placed on the Endangered Species List because it is close to extinction if it is not already extinct. Also, this species is confined to a very restricted habitat (See Section IV) and as stated by Hubbs and Peden (1969), "A slight alteration of the river channel could easily exterminate G. georgei".

IX. References:

- Bernard Johnson Engineers, Inc. 1969. Flood control considerations for urban renewal areas, San Marcos, Texas. Bernard Johnson Engineers, Inc. Houston, Texas. 22p.
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- Gehlbach, F. 1975. Toes Watch-List of Endangered, Threatened, and Peripheral Vertebrates of Texas. Texas Organization for Endangered Species, Publication 1. 12p.
- Hubbs, Clark. 1976. A check list of Texas freshwater fishes. Texas Parks and Wildlife Department. Technical Series no. 11, 12p.
- Hubbs, Clark and E. A. Delco, Jr. 1960. Mate preference in males of four species of gambusiine fishes. Evolution 14:145-152.
- Hubbs, Clark and A. E. Peden. 1969. Gambusia georgei sp. nov. from San Marcos, Texas. Copeia 2:357-364.
- Miller, R. R. 1972. Threatened freshwater fishes of the United States. Trans. Amer. Fish. Soc. 101:239-252.

- Schenck, J. R. 1975. Ecology of the fountain darter, Etheostoma fonticola (Osteichthyes: Percidae). M. S. Thesis, Southwest Texas State Univ., San Marcos. 100p.
- Whiteside, B. G. 1974. Fishes of the upper San Marcos River, Texas. Environmental Assessment Report to Glenn Longley, Southwest Texas State University, San Marcos, to be used in an overall report for a grant from the soil Conservation Service. 25p.
- Young, W. C., B. G. Whiteside, G. Longley, and N. E. Carter. 1973. The Guadalupe-San Antonio-Nueces River Basin project. Review of existing biological data, Phase I: Final Report to Texas Water Development Board. 400p.

X. Photographs Of The San Marcos Gambusia:

- A. This Is A Photograph Of Fig. 1 From Hubbs and Peden, (1969) (This was the only picture I could find of a female G. georgei).
- B. Two Photographs Of The Male G. georgei From The Whiteside (1974) Collection.
- C. Photograph Of The Gonopodium Of The Speciman From The Whiteside (1974) Collection.
- D. Photograph Of The Type Locality For G. georgei.

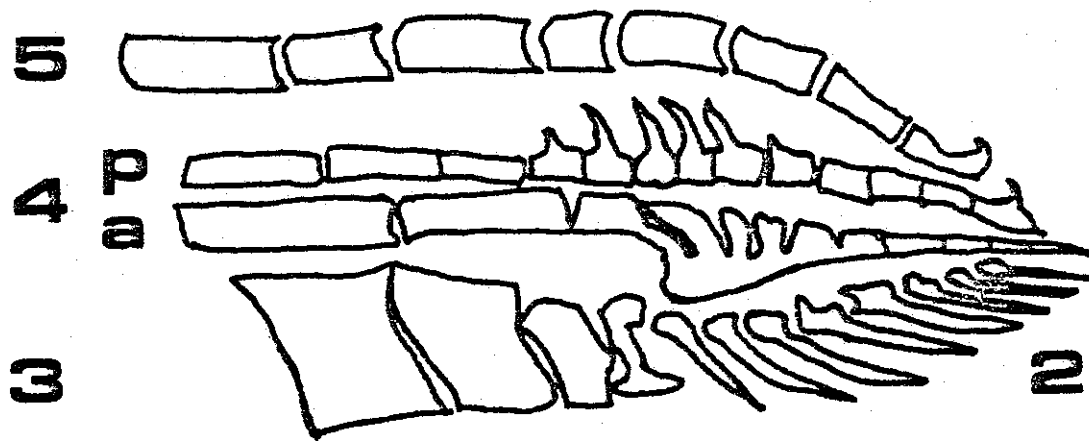


Figure 1. Diagram of gonopodial tip of Gambusia georgei. Taken from Hubbs and Peden, 1969.

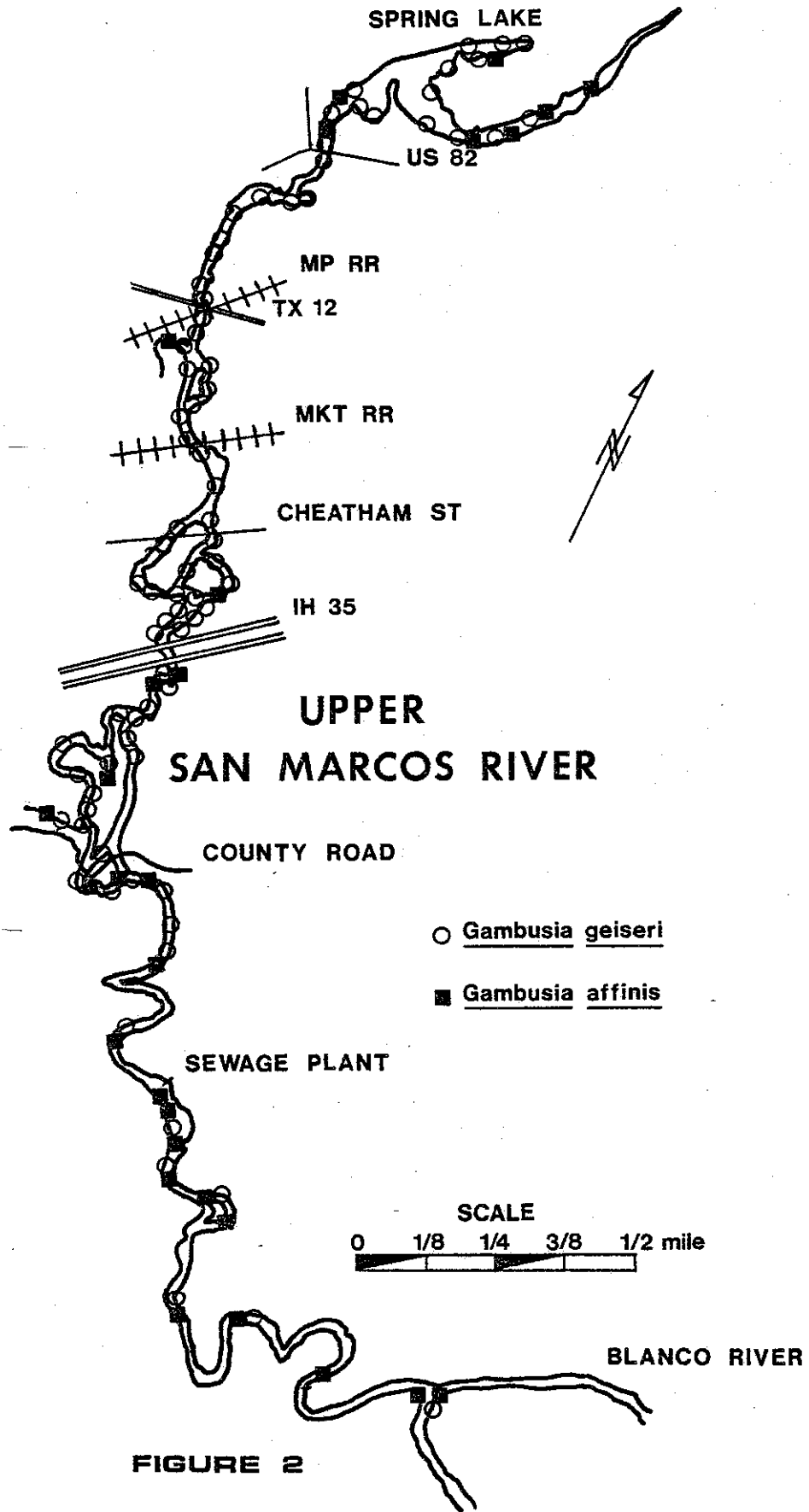


FIGURE 2

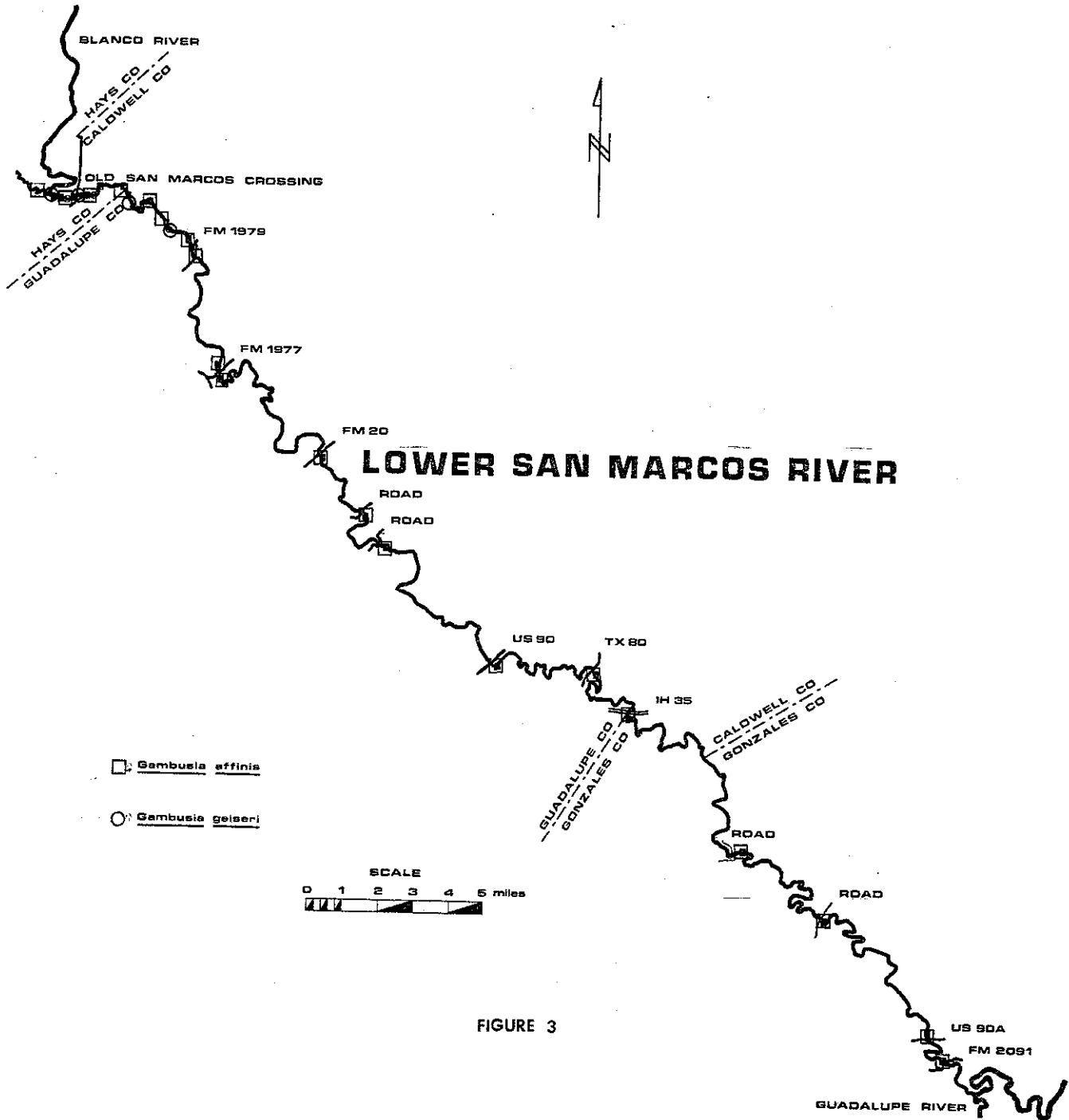


FIGURE 3

