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A Distributional Survey of the Fishes of San Luis Potosi, Mexico.

Richard T. Gregg

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A DISTRIBUTIONAL SURVEY OF THE FISHES OF
SAN LUIS FOTOSI, MEXICO

A Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in
The Department of Zoology

by
Richard T. Gregg
B.S., University of Michigan, 1947
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ABSTRACT

Intensive efforts were made during the years 1951 through 1954 by expeditions of the Louisiana State University Museum of Zoology to secure representative samples of fishes from all parts of San Luis Potosí. These efforts resulted in the collecting of over 10,000 specimens, including representatives of the two new species of poeciliids and three new subspecies of cyprinids described in this report and a new genus and species of cyprinodontid for which Dr. Robert R. Miller of the University of Michigan Museum of Zoology is preparing the description.

In this report, brief descriptions of the physiographic areas and the parts of the Pánuco drainage in San Luis Potosí are given to furnish a groundwork for the discussion of the ichthyofauna and its distribution. These are followed by additional basic information in the nature of a check list of the fishes of the state and a brief account for each form. These accounts consist of the correct scientific name, a citation of the original description, a statement of the type locality, a brief morphological description, a statement of the range, a statement of the distribution in San Luis Potosí, a list of the localities in San Luis Potosí from which specimens were examined, a list of other localities from which the form has been recorded in the state, a brief section on the natural history of the form, and a brief section containing other pertinent remarks.

In the latter half of the report, the ichthyofauna as a whole
is discussed from the viewpoint of its origin, affinities, and distribution. The indigenous ichthyofauna of San Luis Potosí was found to consist of 14 forms with North American affinities, 16 forms with Central and South American affinities, 12 forms with marine affinities, and five forms with purely Mexican affinities.

The fishes of the state show a high degree of endemism. Four genera, 17 species, and 22 forms are endemic to the Pánuco basin. Of these, three genera, 12 species, and 16 forms are endemic to the part of the Pánuco basin lying in San Luis Potosí.

The Pánuco basin is a zone of transition between the Neotropical and Nearctic Realms. In this study, the Pánuco basin is divided into seven sections on the basis of the distribution of its fauna. Three of these, the Tampico, Tamesí, and Moctezuma Sections, lie wholly outside the boundaries of San Luis Potosí. The sections found within the state are the Huasteca Section, the Tanlacta Section, the Río Verde Section, and the Santa María Section. The Huasteca Section in turn has been divided into the Tamuín Subsection, the Valles Subsection, the Rascón Subsection, and the Tamazunchale Subsection.

The factors influencing distribution are discussed in relation to broad distributional patterns throughout the state, as well as to limited distributional patterns within restricted parts of individual streams. The post-Cretaceous geological history of the area and the time of invasion by the various species seem to have had the greatest effect on broad distribution. Local distribution seems to be determined primarily by the combined effects of physical and biotic factors.
INTRODUCTION

The history of ichthyological investigations in San Luis Potosí is rather brief and spotty. Apparently the first scientific specimens collected in the state were four cichlids received August 24, 1891, by the United States National Museum. These were collected by Professor Alfredo Dugés of Guanajuato, who gave the locality from which they were taken as the Huasteca Potosina in San Luis Potosí. These specimens were designated as the types of *Acara bartoni* by Bean. As is indicated in the account for *Cichlasoma bartoni*, there are several factors that suggest that the specimens actually came from the vicinity of the city of Río Verde. Two additional specimens collected at the same stated locality by Dugés were described by Pellegrin (1903) as the types of *Heros labridens* [= *Cichlasoma steindachneri*].

The next ichthyological investigations concerned with the Pánuco basin and San Luis Potosí were those of Jordan and Snyder in 1899. Collections were made in the field in the vicinity of Rasçon, and a number of additional specimens were purchased in the markets at Tampico. The latter specimens were presumed to have come from the immediate vicinity of Tampico. These investigations resulted in the naming of a number of new species, several of which have Rasçon as the type locality.

Far more extensive were the studies of Meek (1904) on the freshwater fishes of México. The portion of the studies concerned with the Pánuco basin and with San Luis Potosí were based on available published
works and the following previously unreported collections: those made by Meek himself at Valles and Rascón in San Luis Potosí, Tampico and Forlón in the state of Tamaulipas, San Juan del Río in Querétaro, and Tula in Hidalgo; and those made by W.L. Tower in 1904 at Río Verde in San Luis Potosí. Meek recorded a total of 32 species from the Pánuco basin. However, if one eliminates the named forms that are now regarded as invalid, Meek's list contained only 26 species found in San Luis Potosí. In 1907, Meek reported on a small collection he had made in 1906 at Jesús María, San Luis Potosí, which is apparently the first collection from the western part of the state. This collection added three species to the ichthyofauna known to occur in San Luis Potosí.

Following this period of intensive study, interest in Mexican ichthyology seems to have lagged until the middle 1920's. At this time there appeared a number of taxonomic studies based on specimens collected at the turn of the century rather than on any new materials. These investigations resulted in the naming of a number of new species that earlier workers had not distinguished. The last statement is particularly true of the species of Gambusia in the Pánuco basin. Hubbs (1926) identified four forms, three of them new, among the specimens designated as Gambusia affinis by Meek.

Following the opening of the Pan-American highway, a number of workers made collections in the middle and late 1930's in the eastern part of the state. These activities were primarily concerned with the accumulation of data on the blind characins of the area and the accumulation of living and preserved specimens for detailed studies on the
genetics and morphology of various poeciliids. Additional collections were made in the western part of San Luis Potosí at Venado, Agua del Medio, and Moctezuma by C.L. Lundell and party in 1934 and at Santa María del Río by Myron Gordon and party in 1932. The primary objective of these collecting activities was the securing of materials to be used in the revision of the family Goodeidae by Hubbs and Turner (1939).

Beginning in 1946, personnel of the Louisiana State University Museum of Zoology made a number of expeditions to San Luis Potosí to secure specimens of the vertebrate fauna of that area. By 1951, these activities had resulted in the accumulation of many thousands of mammals, birds, reptiles, and amphibians, which furnished the bases for a number of publications on the mammalogy, ornithology, and herpetology of San Luis Potosí. However, the ichthyofauna of the state was represented in these extensive collections by less than 50 specimens. The incomplete knowledge of the ichthyofauna of San Luis Potosí and the poor representation of fishes in the Museum's extensive collections of vertebrates from the area made ichthyological investigations very desirable.

I was privileged to be a member of several expeditions which spent a total of more than 12 months in San Luis Potosí during the period of 1951 through 1954. The more than 10,000 specimens of fish collected on these expeditions furnish the primary basis for this report. On one brief trip of only a few days' duration, I was accompanied by Dr. Grover E. Murray of the School of Geology at Louisiana State University. Many of the remarks on the geology of the state are based on his observations. It is regrettable that these observations are the
results of cursory examinations rather than detailed studies, but they are the best information available for San Luis Potosí, with the exception of the coastal plain area.
San Luis Potosí is a small state in east-central México, lying between 21°11' and 24°34' North latitude and between 98°23' and 102°13' West longitude. Its irregular boundaries encompass an elongate area of 63,241 square kilometers (24,411 square miles) with its longer axis (approximately 400 kilometers) running from northwest to southeast.

Three very definite physiographic areas, the Gulf Coastal Plain, the Sierra Madre Oriental, and the Mexican Plateau, are encountered within the state. Of these, the Mexican Plateau contains about four-fifths of the state. The remainder of the state, with the exception of a small area of Gulf Coastal Plain approximately 40 kilometers wide and 60 kilometers long in the northeast corner, lies within the Sierra Madre Oriental and its foothills.

The Gulf Coastal Plain is an arid, relatively level area, lying at an elevation of less than 75 meters and lacking a well-developed drainage pattern. The major bodies of water within the coastal plain area are the lower stretches of the Río Santa María and the Río Moctezuma and a few shallow lakes of varying degrees of intermittency. The rest of the drainage in this area consists of intermittent arroyos.

In the northeast part of San Luis Potosí the Sierra Madre Oriental and its foothills consist of parallel ridges trending from north to south and covering an area approximately 60 kilometers wide. In the southeast part of the state the mountainous area becomes approximately 80 kilometers wide and has a much more irregular arrangement.
crest of the Sierra Madre Oriental averages approximately 1500 meters in elevation with some of the peaks reaching a much greater elevation. From the coastal lowland the Sierra appears as an impressive chain of mountains rising abruptly from the plain, but from the plateau it appears as an insignificant chain of low hills. Climatic conditions in the Sierra vary from arid in the extreme eastern foothills to very humid in the cloud-forest belt of the higher slopes. The drainage system in this area consists of two trunk streams, the Río Santa María and the Río Moctezuma, each arising on the plateau and cutting through the mountains, where they receive tributaries from the intermontane valleys.

The Mexican Plateau in San Luis Potosí is a great block of Cretaceous sedimentary rocks, largely limestone, which is overlaid, particularly in the southwestern part, by extensive areas of rhyolite. It is an area of broad plains, valleys, and mountains, rising from a general elevation of approximately 1200 meters in the east to a general elevation of approximately 2000 meters in the west. The plateau is more or less arid, with the degree of aridity increasing as one goes north or west. The bulk of the plateau within San Luis Potosí, approximately two-thirds of the entire state, is basin drainage with intermittent waters of a highly alkaline and saline nature. South and east of the city of San Luis Potosí are found the headwaters of the Río Santa María and the entirety of its tributary, the Río Verde.

Climatic conditions in all three of the physiographic areas vary seasonally. The rainy season generally begins in late May or early
June and extends through late September or early October. In addition to this seasonal variation in rainfall, there has been a progressive increase in the aridity of the plateau, which has been noted even within historical times.
The names of bodies of water in San Luis Potosí tend to be very unstable. This is particularly true of the rivers, as their names may be changed from one time to another, from one map to another, and from one locality to another. The designations to be used herein for the waters showing the greatest instability in their names are as follows:

Río Santa María — variously known in its separate parts as the Río Santa María, Río Pujaí, and Río Tamuín.
Río Valles — also known as the Río Salto, Río Meco, Río Naranjos, Río Abra de Caballeros, Río Abra de Caballos, Río Santo, Río Micos, and Río Tampaon.
Río Coy — also known as the Río Parrodi and Río Ojilipán.
Río Frío — variously referred to as the Río Frío de Gallinas, Río de Gallinas, Río Rascón, and the Río Verde. The use of the last name has led to considerable confusion in distributional records.
Laguna de las Rusias — shown on some maps as Laguna Refugio and at times referred to locally as La Presa.

The river system of San Luis Potosí consists of the lower reaches of the southern drainage (Río Moctezuma and its tributaries) and the bulk of the central drainage (Río Santa María and its tributaries) of the Río Panuco, which empties into the Gulf of Mexico just east of the city of Tampico after meandering across the coastal plain of northern Veracruz.
The major stream of San Luis Potosí is the Río Santa María, which is, by American standards, a small to medium-sized river. It has its beginning in springs in Guanajuato just south of the San Luis Potosí-Guanajuato border and it unites with the Río Moctezuma at the eastern border of the state to form the Río Pánuco.

The Río Santa María first enters San Luis Potosí at Laguna de las Rusias, a shallow mud bottomed lake that receives its name from the extensive areas of emergent aquatics. Laguna de las Rusias is a natural body of water that has had its area greatly increased by means of a low masonry dam built in conjunction with its development as a resort area and as a source of water for irrigation. The surface area of the impoundment varies from 500 to 1000 acres depending on the amount of rainfall, but this variation is accomplished by a change of only two feet or so in the water level. At present the laguna is suffering from neglect and is rapidly filling with sediments brought in by surface run-off from the surrounding area.

From Laguna de las Rusias the Río Santa María flows for about 10 miles through a broad valley as a small creek whose water is used extensively for irrigation. About eight miles northeast of the town of Villa de Reyes, the river turns to the southeast and enters the mountainous area encompassing the plateau of southern San Luis Potosí and northern Guanajuato and Queretaro. Within the mountainous area the Río Santa María receives numerous tributaries, and its volume of flow becomes highly dependent on the amount of rainfall in the area. At the town of Santa María del Río the river has a bed about 75 feet
wide with a sand and gravel bottom. Here the stream may vary seasonally
from a few isolated pools to a stream 20 to 30 feet wide flowing through
pools three to four feet deep and across riffles about a foot deep.
Southeast of Santa María del Río the river receives water from a number
of springs and becomes a permanent stream with an increased gradient.

At a point approximately 20 miles southeast of Santa María del
Río the Río Santa María leaves San Luis Potosí and flows through the
mountainous area of northern Guanajuato and Queretaro, forming at places
the boundary between these states and San Luis Potosí. During this
portion of its course, the river descends from an elevation of 1600
meters to an elevation of 250 meters at an average gradient of approx­
imately 0.8% as compared to the average gradient of approximately 0.3%
for the portion on the plateau in San Luis Potosí, 0.25% for the portion
in the Sierra Madre Oriental, and 0.04% for the portion on the coastal
plain.

The Río Santa María re-enters San Luis Potosí on the extreme
eastern edge of the plateau at a point 30 miles southwest of Pujal.
At this point the Río Santa María is a stream some 40 to 50 feet wide
with alternating pools five to six feet deep and with rapids two to
three feet deep. Its union with the Río Verde several miles to the
northeast approximately doubles the size of the river but leaves its
characteristics essentially unchanged.

Shortly after its union with the Río Verde, the Río Santa María
flows into deep canyons transecting the Sierra Madre Oriental. Here it
receives the waters of the Río Frío, a small tributary in an intermon­
tane valley, and alternates between very abrupt, turbulent rapids and
long, placid, very deep pools with sheer rock walls and crystal clear water.

Upon emerging from the main range of the Sierra Madre Oriental, the Río Santa María receives the Río Valles, a moderate-sized river lying in an intermontane valley just west of the easternmost ridge of the foothills, and flows onto the coastal plain to become a sluggish, turbid, meandering river.

The principal tributary of the Río Santa María on the plateau is the Río Verde. The Río Verde arises at Puerta del Río, a large spring nine kilometers south of Villa Juárez (formerly Carbonera), and empties into the Río Santa María 80 miles to the southeast. From its point of origin to a point eight miles southeast of the city of Río Verde, it is a small clear stream that flows slowly through a broad level valley. Just south of the city of Río Verde the volume of flow is more than doubled by the addition of water from La Media Luna, a marshy area five miles to the southwest that has one very large spring and numerous smaller ones. In the vicinity of Río Verde the waters of the river and La Media Luna are used for irrigating extensive areas. Slightly northwest of the city the Río Verde receives an intermittent tributary, the Río Santa Catarina, which drains the eastern slopes of the mountain range separating the Río Verde Valley from the San Luis Potosí Valley and the headwaters of the Río Santa María.

Upon entering the mountains southeast of the city of Río Verde, the river flows through a series of small gorges with considerable increase in current and turbidity. Thirty miles southeast of Río Verde
the river joins a tributary arising north of Rayón and draining the mountains east of the Río Verde Valley. From here to its union with the Río Santa María, some 20 miles to the east, the river, winding through narrow valleys, is generally 40 to 50 feet wide and four to six feet deep.

The Río Frío is a small tributary of the Río Santa María, lying in an intermontane valley of the Sierra Madre Oriental. East of Ciudad del Maíz it is of an intermittent nature, but farther south in the valley it is a small, clear stream with alternating rapids and pools.

The largest tributary of the Río Santa María is the Río Valles, a river arising in the Sierra Madre Oriental of southern Tamaulipas and emptying into the Río Santa María at Pujal. From its point of entry in northeast San Luis Potosí to a point ten miles northwest of Valles, the river may be characterized as a moderate-sized, clear, cool stream flowing through quiet pools and rapids and tumbling over numerous falls, which vary in height from a few feet to over 150 feet for El Salto. The lower part of the Río Valles is more sluggish and lacks the falls. Even in a state where the water levels fluctuate violently, the Río Valles is notable, as its level may rise more than 15 feet in several hours when heavy rains fall in the Sierra Madre Oriental.

Two other streams, the Río Coy and the Río Choy, are minor tributaries of the Río Santa María. The Río Coy arises from a large spring, El Nacimiento del Coy, in the foothills 22 miles south of Valles and empties into the Río Santa María midway between Pujal and Tamuín. This
river is a very clear stream with steep, heavily wooded banks and is 20 to 30 feet wide and eight to ten feet deep. Of all the rivers in San Luis Potosí, it shows the least variation from season to season and throughout its course. The Río Choy is a very small stream arising from a spring five miles west of Tamuín and flowing into the Río Santa María at Tamuín.

Of much less importance in San Luis Potosí than the Río Santa María drainage, which encompasses approximately 8000 square miles of plateau, mountains, and coastal plain, is the Río Moctezuma drainage, which encompasses approximately 1000 square miles of mountains and coastal plain in the southeastern part of the state. However, the Río Moctezuma system is much more extensive than this statement would indicate, as the Río Moctezuma and its tributaries drain the bulk of Hidalgo and parts of Distrito Federal, México, Queretaro, and Veracruz in addition to the small part of San Luis Potosí.

The Río Moctezuma from its point of entry into the state about eight miles southwest of Tamazunchale to its union with the Río Amajaquí at Tamazunchale is a swiftly flowing, highly turbid stream generally 40 to 50 feet wide and three to five feet deep that flows through deep, narrow valleys. From here to a point some 25 miles to the northeast, where it becomes a sluggish, meandering river of the coastal plain, the Moctezuma flows through fairly broad valleys among the foothills as a river from 75 to 100 feet wide and four to eight feet deep with a reduction in current but little or no reduction in turbidity.

Additional parts of the Río Moctezuma drainage found in San Luis
Potosí are the lower four or five miles of the Río Amajaqui, a river equal in size to the Moctezuma but clearer and more sluggish; the lower two or three miles of the Río Claro, a small, clear stream of pools, small falls, riffles, and rapids emptying into the Río Amajaqui about three miles south of Tamazunchale; and the entirety of the Río Axtla, a small, clear stream of characteristics similar to the lower Río Valles, flowing about 15 miles through the foothills of the Sierra Madre Oriental.

In addition to the surface drainage within the state, there is a well-developed subsurface drainage, which Tafall (1946) likens to the Karst of the Balkans. Abundant evidence of this subsurface drainage is present in the form of numerous caves and springs.
MATERIALS AND METHODS

The present study has three objectives: (1) to enumerate all the kinds of fishes known to occur in San Luis Potosí; (2) to determine the distribution of the various fishes within the state; and (3) to inquire into the factors responsible for this distribution.

The individual species accounts have been standardized as much as is possible. Each typical account begins with the correct scientific name and the citation of the original description. The next item is a brief statement of the type locality. In several cases, rather indefinite type localities within San Luis Potosí have been restricted when the evidence compiled during the course of the study seemed to justify such action.

The descriptions of the species have been held to a brief notation of the more significant counts and measurements and a brief account of the coloration. The measurements and counts were made in the manner prescribed by Hubbs and Lagler (1949). Measurements of over 20 mm. were estimated to tenths of a millimeter by spanning the prescribed distance with dividers and then placing the dividers on a millimeter rule. Measurements under 20 mm. were made with proportional dividers with the arm ratio set at 10:1. The part to be measured was spanned with the short arms of the proportional dividers with the specimen under appropriate magnification of a binocular dissecting scope. The measurement of the part was taken as one-tenth of the distance spanned on a millimeter rule by the long arms of the dividers.
Results indicate an accuracy within the limits of plus or minus 1.0 mm. for measurements over 20 mm. and 0.15 mm. for measurements under 20 mm. Each recorded measurement for a specimen was the average of three measurements taken in the manner described. The proportions given in the descriptions were obtained by mathematical calculations based on the recorded measurements for the parts concerned. The descriptions are based on the analysis of specimens from all localities where the species was collected. When specimens from a locality were sufficiently numerous, ten specimens of each general size (small, medium, and large) were selected for analysis. When the size of the sample was too small for this type of treatment, all of the specimens from the locality were examined. In the species showing marked sexual dimorphism, this treatment was applied to each sex.

The over-all distribution of the form is indicated under the heading of "Range" and its more limited distribution in relation to San Luis Potosi is found under the heading "Distribution in San Luis Potosi." Specific locality records for the occurrence of the form in San Luis Potosi are to be found under the headings "Specimens examined" and "Other collection records." The localities under "Specimens examined" include all localities represented by specimens in the Louisiana State University Museum of Zoology and a few additional localities represented by specimens received on loan from other institutions. "Other collection records" includes localities reported in published works and the unpublished records of the University of Michigan Museum of Zoology (UMMZ). A number of localities in the categories
covered by "Other collection records" coincide with localities from which specimens have been examined. These have been omitted to avoid duplication.

The paragraph on natural history briefly states habitat preference, food habits, reproduction, and general behavior. Other pertinent information that is not ideally suited to the aforementioned categories is relegated to a brief closing paragraph under the heading "Remarks."

In the field work, an attempt was made to secure representative collections from the various types of habitat at intervals along each stream in the state. Particular emphasis was placed on collecting in areas for which no collecting records existed. Similar emphasis was placed on areas that seemed likely to be critical in relation to the distribution of the various forms. Specimens were secured by use of traps, seines, explosives, and poisons, with the method of capture being determined by the suitability of the various devices to the individual localities. In an additional attempt to insure adequacy of sampling, collecting activities were carried on at night as well as during the day.
CHECK LIST OF THE FISHES OF SAN LUIS POTOSI

Class TELEOSTOMI
Subclass ACTINOPTERYGII

Order LEPISOSTEIFORMES

Family Lepisosteidae
Lepisosteus spatula Lacepede
Lepisosteus osseus (Linnaeus)

Order CLupeiformes

Family Clupeidae
Dorosoma cepedianum (LeSueur)
Dorosoma petenense (Gunther)

Order Cypriniformes

Family Characidae
Astyanax fasciatus mexicanus (Filippi)
Anoptichthys jordani Hubbs and Innes
Anoptichthys hubbsi Alvarez

Family Catostomidae
Ictiobus bubalus (Rafinesque)
Ictiobus labiosus (Meek)

Family Cyprinidae
Cyprinus carpio Linnaeus
Carassius auratus (Linnaeus)
Alganaea affinis Regan
Dionda rasconis rasconis (Jordan and Snyder)
Dionda rasconis huastecensis new subspecies
Dionda rasconis rioverdensis new subspecies
Notropis calientis potosensis new subspecies
Notropis lutrensis forlonensis Meek

Family Ameiuridae
Pilodictis olivaris (Rafinesque)
Ictalurus furcatus (LeSueur)
Ictalurus mexicanus (Meek)
Ictalurus punctatus (Rafinesque)

Order Anguilliformes

Family Anguillidae
Anguilla rostrata (LeSueur)
Order CYPRINODONTIFORMES

Family Cyprinodontidae
  Cyprinodon variegatus Lacepede
  Cyprinodontidae new undescribed genus and species

Family Goodeidae
  Ataeniobius toweri (Meek)
  Xenotoca variata (Bean)
  Goodea gracilis Hubbs and Turner
  Xenoophorus captivus captivus (Hubbs)
  Xenoophorus captivus exaul Hubbs and Turner

Family Poeciliidae
  Gambusia affinis (Baird and Girard)
  Gambusia axila new species
  Gambusia panuco Hubbs
  Gambusia vittata Hubbs
  Pseudoxiphophorus bimaculatus jonesi (Gunther)
  Mollienesia sphenops sphenops (Cuvier and Valenciennes)
  Xiphophorus milleri new species
  Xiphophorus montezumae Jordan and Snyder
  Xiphophorus pygmaeus Hubbs and Gordon
  Xiphophorus variatus (Meek)

Order MUGILIFORMES

Family Mugilidae
  Mugil curema Cuvier and Valenciennes
  Agonostomus monticola (Bancroft)

Order PERCIFORMES

Family Centropomidae
  Centropomus undecimalis (Bloch)

Family Centrarchidae
  Micropterus salmoides (Lacepede)
  Lepomis macrochirus Rafinesque

Family Pomadasyidae
  Pomadasys boucardi (Steindachner)

Family Sciaenidae
  Aplodinotus grunniens Rafinesque

Family Cichlidae
  Cichlasoma baroni (Bean)
  Cichlasoma cyanoguttatum carpinte (Jordan and Snyder)
  Cichlasoma steindachneri Jordan and Snyder

Family Eleotridae
  Gobiomorus dormitor Lacepede

Family Gobiidae
  Awaous taiasica (Lichtenstein)
ACCOUNTS OF THE SPECIES AND SUBSPECIES

Family LEPISOSTEIDAE

LEPISOSTEUS SPATULA LACEPÈDE


*Type locality.*— None given in the original description. The first locality accompanying a description of the species is the Ohio River cited by Rafinesque in 1820.

*Description.*— Maximum depth of body contained 7.5-8.0 times and the length of the head contained 2.7-3.3 times in the standard length. Length of the snout contained 1.8-2.1 times and the diameter of the eye contained 9.5-10.0 times in the length of the head. The width of the snout contained 1.8-2.2 times in its length. Dorsal fin with 7-8 rays. Anal fin with 7-8 rays. Lateral line with 58-60 scales.

Olive green to olive brown dorsally and buffy ventrally. Dorsal and caudal fins pale yellow with numerous large black spots. Other fins buffy to pale olive green and unmarked.

*RANGE.*— Southeastern United States and northeastern México south to the Río Pánuco.

*Distribution in San Luis Potosí.*— Found in the streams of the lowlands and foothills and in the Río Santa Marfa in the gorges in the Sierra Madre Oriental.

*Specimens examined.*— El Nacimiento del Coy, Puente de Dios, and Laguna Ebano (numerous skeletal remains).
Natural history.— Found in the quieter portions of the streams and lakes where it feeds on large invertebrates and fish. It does not seem to be very abundant at any locality other than in Laguna Ebano, where it forms a major element of the population.

LEPISOSTEUS OSSEUS (LINNAEUS)


Type locality.— Virginia.

Description.— Maximum depth of body contained 10–12 times and the length of the head contained 2.6–3.1 times in the standard length. Length of the snout contained 1.3–1.5 times in the length of the head. Snout 15–20 times as long as its minimum width. Dorsal fin with 7–8 rays and the anal with 8–9 rays. Lateral line with 58–62 scales.

Coloration as in the alligator gar except that the anal fin is spotted and the lateral surfaces, particularly the caudal peduncle of young specimens, has scattered brown spots.

Range.— From the Great Lakes to the Río Pánuco.

Distribution in San Luis Potosi.— In the streams and lakes of the lowlands and foothills.

Specimens examined.— El Nacimiento del Coy, Laguna Ebano.

Other collection records.— Valles (UMMZ).

Natural history.— Its habits are much the same as those of the alligator gar. Apparently it is less abundant than the alligator gar.
Family CLUPEIDAE

DOROSOMA CEPEDIANUM (LE SUEUR)


Type locality.— Delaware and Chesapeake Bays.

Description.— Maximum depth of the body contained 2.5-3.0 times in the standard length and the length of the head contained 2.8-3.4 times. Diameter of the eye contained 3.4-4.0 times in the length of the head and the minimum depth of the caudal peduncle contained 2.8-3.7 times. Dorsal fin with 12 rays and the anal with 27-34 rays. Longitudinal series with 54-63 scales.

Pale olive green dorsally and silvery laterally and ventrally. All fins dusky and a black spot about the size of the eye located in the shoulder region.

Range.— From New Brunswick south along the coast and through the Mississippi basin to the Río Pánuco basin.

Distribution in San Luis Potosí.— Limited to the waters of the lowlands and foothills.

Specimens examined.— Valles, Puente de Dios, El Nacimiento del Coy.

Natural history.— This species appears to prefer the larger clear streams. At no locality in the state does it appear to approach the abundance it attains in the southern United States.
**DOROSOMA PETENENSE** (GUNTER)


**Type locality.**—Lake Potén, Yucatán, México.

**Description.**—Maximum depth of the body contained 2.5-3.0 times and the length of the head contained 2.8-3.5 times in the standard length. Diameter of the eye contained 3.4-3.9 times in the length of the head. Dorsal fin with 13-14 rays and the anal with 22-25 rays. Longitudinal series with 40-42 scales.

Pale olive green dorsally and silvery laterally and ventrally. The eye, the area immediately posterior to the eye, and the opercle strongly suffused with yellow. The dorsal fin dusky and the rest of the fins yellow. The black humeral spot is smaller than the pupil of the eye.

**Range.**—Coastal areas from Florida to Yucatán.

**Distribution in San Luis Potosí.**—Limited to the waters of the lowlands and foothills.

**Specimens examined.**—Laguna Ebano, Arroyo Huichi, Río Choy at Rancho Colandria, Arroyo Largatija, Río Moctezuma at Tamazunchale.

**Natural history.**—This species seems to be equally abundant in the larger rivers, arroyos, and lakes. In all types of habitat it is much more abundant than *Dorosoma cepedianum*. It seems that most of the individuals penetrating as far inland as San Luis Potosí are young individuals.
Family CHARACIDAE

ASTYANAX FASCIATUS MEXICANUS (FILIPI)


Type locality. — México.

Description. — Maximum depth of the body contained 2.6-3.2 times in the standard length and the length of the head contained 3.2-4.1 times. Diameter of the eye contained 3.1-4.6 times in the length of the head and the minimum depth of the caudal peduncle contained 1.9-2.9 times. The dorsal fin with 9 or 10 rays and the anal with 18-24 rays. The lateral line with 32-37 scales.

Dorsal surface light olive green to dark olive green. Lateral and ventral surfaces silvery. A faint plumbeous lateral band extending from the black humeral spot to the elongated black caudal spot. Caudal, pelvic, and anal fins yellow to orange, the anal and pelvics being margined with red in breeding individuals.

Range. — Found in all streams draining into the Gulf of Mexico from the Río Papaloapan in southern Veracruz to the Guadalupe River in Texas and in the Río Balsas and Río Grande de Santiago of the Pacific drainage.

Distribution in San Luis Potosí. — This form is found in all surface waters of the state that have natural populations of fishes, with the exception of the small isolated drainages in the vicinity of Moctezuma and Venado. In addition, it is occasionally found in sub-surface waters.
Specimens examined.— Specimens were examined from all localities listed in the gazetteer for the LSUMZ collections with the exception of Moctezuma, Presa Gonzalo Santos, Presa San José, Mesquitic, and Cueva de los Sabinos.

Other collection records.— Río Moctezuma 2 mi. SW of Tamazunchale, Río Axtla at Axtla, Río Coy 1 mi. E of Santa Isabel (UMMZ). Jesús María (Meek 1907).

Natural history.— This small characin is an extremely active and aggressive predaceous form with a wide tolerance for habitats. The food is primarily insects and small crustaceans for the smaller individuals and a combination of these and small fish, including young of their own kind, for the larger individuals. However, they will eat nearly any edible thing they encounter and by the combined attack of hundreds of individuals of all sizes will consume a large fish if it is disabled. Food is apparently located by perception of chemical, vibratory, and visual stimuli as indicated by responses to various objects introduced into the water in different manners. Throwing any object into the water causes an immediate convergence of all individuals within a radius of eight to ten feet. Placing a piece of meat in the water induces a somewhat erratic response over a slightly larger area. The placing of a rock or similar object in the water causes an immediate response, but only for a radius of three to four feet.

Meek (1904) gives the breeding season as late May and early June, but I have taken individuals with well-developed ova in the additional months of January, February, July, August, and September, thereby
indicating breeding throughout the year. Additional indication of breeding throughout the year is furnished by the presence of individuals of all sizes at all times of the year and the complete lack of any size classes within the population. However, the breeding seems to build up from a winter low to a late spring and early summer peak and then taper off.

**ANOPTICHTHYS JORDANI HUBBS AND INNES**


**Type locality.**— Cueva Chica, Pujal, San Luis Potosí, México.

**Description.**— The characters of this species are essentially the same as those of *Astyanax fasciatus mexicanus* with the major differences being the lack of pigment and the imperfect development of or lack of eyes. Álvarez (1946) distinguishes this form from the other members of the genus by the nature of the suborbitals (third usually divided into numerous portions, fourth never fused to the fifth, and the sixth entire), the heavier caudal peduncle (minimum depth contained less than three times in the length of the head), and the smaller head (its length contained more than 3.2 times in the standard length).

**Range.**— Same as its distribution in San Luis Potosí.

**Distribution in San Luis Potosí.**— Known only from Cueva Chica, the type locality.

**Specimens examined.**— None.
ANOPTICHTHYS HUBBSI ALVAREZ


Type locality.— Cueva de los Sabinos, San Luis Potosí, México.

Description.— The characters of this form are essentially the same as those of Anoptichthys jordani. However, the eye is even more degenerate in this form. Alvarez (1946) distinguishes this form from the other members of the genus by the nature of the suborbitals (the fourth sometimes fused to the fifth and divided in two, and the sixth always divided into two), the more slender caudal peduncle (its least depth contained 3 or more times in the length of the head), and the larger head (its length contained about 3 times in the standard length).

Range.— See distribution.

Distribution in San Luis Potosí.— Limited to Cueva de los Sabinos near Los Sabinos.

Specimens examined.— Cueva de los Sabinos.

Remarks.— Extensive studies on the morphology and behavior of the blind characins have been made for a period of approximately 20 years by a number of workers, particularly Dr. C.M. Breder, Jr., and his associates at the American Museum of Natural History. The results of these studies indicate that the eventual taxonomic action may be the reduction to the status of subspecies (possibly a single subspecies of Astyanax fasciatus) for the three nominal forms (A. jordani, A. hubbsi, and A. antrobus, the last of Cueva de El Pachón in Tamaulipas) and two unnamed forms (from Sotano de la Arroya and Sotano de la Tinaja near Los Sabinos, San Luis Potosí) now placed in the genus Anoptichthys.
Family CATOSTOMIDAE

ICTIOBUS BUBALUS (RAFINESQUE)


Type locality.— Ohio River.

Description.— Maximum depth of body contained 2.4-2.9 times and the length of the head contained 3.4-3.6 times in the standard length. The diameter of the eye contained 4.4-5.0 times in the length of the head and 1.1-1.2 times in the distance from the posterior tip of the maxillary to the front of the mandible. Dorsal fin with 26-28 rays and the anal with 9-10 rays. Lateral line with 36-39 scales.

Medium olive green dorsally and silvery ventrally. All fins a medium olive green.

Range.— From southern Canada south through the Mississippi Valley and along the Gulf coast to the Río Pánuco.

Distribution in San Luis Potosí.— Streams of the lowlands and foothills.

Specimens examined.— Arroyo Largatija, El Nacimiento del Coy, Puente de Dios.

Natural history.— Its habits are essentially the same as those of Ictiobus labiosus, but it is apparently much less abundant.

ICTIOBUS LABIOSUS (MEEK)


Type locality.— Valles, San Luis Potosí, México.
Description.— Maximum depth of body contained 3.1-3.4 times and the length of the head 3.5-3.9 times in the standard length. The diameter of the eye contained 3.9-4.4 times in the length of the head and 0.8-0.9 times in the distance from the posterior tip of the maxillary to the front of the mandible. Dorsal fin with 21-25 rays and the anal with 8-9 rays. Lateral line with 41-44 scales.

Pale olive green dorsally and silvery ventrally. All fins pale olive green and unmarked.

Range.— Basin of the Río Pánuco.

Distribution in San Luis Potosí.— Found in the streams of the lowlands and foothills, and in the middle Río Santa María and the lower Río Verde.

Specimens examined.— Arroyo Largatija, Valles, Tamazunchale, Guayabos, Tanlacú.

Natural history.— This is a scavenger that feeds on detritus on the bottom. It seems to be limited to the larger streams and the portions of smaller streams closely associated with larger streams. It is possible that its spread into the Río Verde Valley and the upper Río Santa María has been prevented by the small size of streams in these areas.

Family CYPRINIDAE

ALGANSEA AFFINIS REGAN

Algansea affinis Regan, Biol. Centrali-Amer., 1907: 151, Tab. 25, fig. 1.
Type locality.-- Aguascalientes, Salamanca, and San Juan del Río, México.

Description.-- Greatest depth of the body contained 3.6-4.3 times in the standard length and the length of the head 3.3-3.9 times. The diameter of the eye contained 4.0-6.4 times in the length of the head and 1.2-2.1 times in the length of the snout. Dorsal fin with 9 rays and the anal with 8 rays. The lower part of the first gill arch with 9-12 rakers. Lateral line with 65-75 scales, separated from the origin of the dorsal fin by 13-15 scale rows and from the base of the pelvics by 8-11 rows.

Dark olive brown dorsally progressing to silvery ventrally. Pectoral, pelvic, anal, and caudal fins pale yellow. A trace of a plumbeous lateral band on the caudal peduncle ending in a black caudal spot.

Range.-- Upper portions of the basins of the Río Lerma, Río Moctezuma, and the Río Santa María.

Distribution in San Luis Potosí.-- Limited to the extreme upper reaches of the Río Santa María and its associated waters.

Specimens examined.-- Bledos, Laguna de las Rusias, and Santa María del Río.

Other collection records.-- Jesús María (Meek 1907).

Natural history.-- This species feeds on plant detritis and prefers the deeper, relatively currentless pools of streams and lakes or ponds.
DIOMDA RASCONIS RASCONIS (JORDAN AND SNYDER)


Type locality.— Río Verde [= Río Frío], near Rascon, San Luis Potosí, México.

Description.— Maximum depth of the body contained 3.3-4.2 times in the standard length, length of the head 3.7-4.0 times. Dorsal fin with 9 rays and the anal with 8-9, usually 9. Diameter of the eye contained 3.2-3.6 times in the length of the head. Lateral line with 35-37 scales, separated by 6 rows of scales from the origin of the dorsal fin and by 5 rows from the origin of the anal.

Dark olive of the dorsal surface becoming lighter laterally and fading to nearly silver on the ventral surface. A dark, well-defined lateral band extending from the tip of the snout to the base of the caudal fin and terminating in a rectangular black caudal spot. In addition there is a narrow, less distinct dark stripe down the mid-dorsal line that also encompasses the base of the dorsal fin.

Range.— This subspecies is apparently restricted to the Río Frío, but other subspecies extend the range of the species to the lower and middle Pánuco basin.

Distribution in San Luis Potosí.— Restricted to the Río Frío.

Specimens examined.— Río Frío near Rascon.

Natural history.— This small cyprinid with a long, highly convoluted intestine feeds on detritus. The breeding season seems to be from late May to early September, as individuals taken during this period may show well-developed gonads.
**DIONDA RASCONIS** **HUASTECHENSIS** new subspecies

**Holotype.**—A female (LSUMZ 6392) with well-developed ova that was collected June 19, 1954, in the Río Axtla at the ferry to Xilitla in San Luis Potosí, México. Standard length 28 mm. Maximum depth of body contained 3.9 times in the standard length, length of the head 3.7 times. Dorsal fin with 9 rays and the anal with 10. Diameter of the eye contained 3.0 times in the length of the head. Lateral line with 33 scales, separated from the origin of the dorsal fin by 5 rows of scales and from the origin of the anal by 4 rows. The coloration as in *D. r. rasconis*.

**Paratypes.**—Twenty-five specimens (LSUMZ 6316), collected with the holotype. Standard length 17-25 mm. Maximum depth of body contained 3.6-4.2 times in the standard length, length of the head 2.8-3.2 times. Diameter of the eye contained 3.0-3.3 times in the length of the head. Dorsal fin with 9 rays and the anal with 9-11, usually 10, rays. Lateral line with 32-34 scales, separated from the origin of the dorsal fin by 5 rows of scales and from the origin of the anal by 4 rows. This subspecies is distinguished from the nominate subspecies by the smaller number of scales in the lateral line, a greater number of rays in the anal fin, the larger head, and the larger eye.

**Range.**—Restricted to the lower Pánuco basin.

**Distribution in San Luis Potosí.**—This is the lowland race of the species and is found in the streams east of the Sierra Madre Oriental.
Specimens examined.— Rio Axtla at the ferry to Xilitla, Arroyo Huichi, Tamazunchale, and Valles.

Other collection records.— Arroyo Palitla, Rio Matlapa at Matlapa, Arroyo Plan de Jalpilla, Rio Axtla at Axtla (UMMZ).

Remarks.— The specimens examined from localities other than the type locality were not designated as paratypes because of the poor condition of these specimens. Information for the specimens in the University of Michigan Museum of Zoology was furnished by Dr. Robert R. Miller and it compares favorably with that given in the description.

DIONDA RASCONIS RIOVERDENSIS new subspecies

Holotype.— A male (LSUMZ 6393), collected August 17, 1953, at Puerta del Rio, San Luis Potosí, México. Standard length 43 mm. The maximum depth of body contained 3.3 times in the standard length, the length of the head contained 3.6 times. Dorsal and anal fins each with 9 rays. Diameter of the eye contained 3.7 times in the length of the head. Lateral line with 42 scales, separated from the origin of the dorsal fin by 6 rows of scales and from the origin of the anal by 5 rows. Coloration as in D. f. rasconis.

Paratypes.— Four series of specimens (LSUMZ 6320, 6321, 6322, 6328), collected at Puerta del Río, La Media Luna, Guayabos, and Tanlauquito. They range up to 59 mm. in standard length. Maximum depth of body contained in the standard length 3.2-3.8 times, length of the head 3.2-4.1 times. Dorsal and anal fins each with 9 rays. Diameter of the eye contained 3.6-4.1 times in the length of the head. The lateral line
with 40-44 scales, separated from the origin of the dorsal fin by 6 rows of scales and from the origin of the anal by 5 rows. This subspecies can be distinguished from the nominate subspecies by the greater number of scales in the lateral line and the smaller eye.

**Range.**—The middle portion of the Río Santa María basin.

**Distribution in San Luis Potosí.**—This subspecies is found in the entire Río Verde drainage and in the closely associated parts of the Río Santa María.

**Remarks.**—Meek (1904) reported *Dionda rasconis* from localities within the range of all three subspecies, but he did not distinguish the various races. There is little reason to doubt that the subspecies of *D. rasconis* have been derived from a single ancestral type that entered the Pénhuco basin at some earlier time. The isolation of the subspecies at the present time results from the lack of suitable food and habitat in the portion of the Río Santa María found in the gorges of the Sierra Madre Oriental.

**Notropis Calientis Fotoensis** new subspecies

**Holotype.**—A mature female (LSUMZ 6391), collected June 23, 1954, at Bledos, San Luis Potosí, México. Standard length 45 mm. Maximum depth of body contained 3.3 times in the standard length and the length of the head 3.7 times. Diameter of the eye contained 4.6 times in the length of the head. Longitudinal series with 37 scales, the lateral line restricted to the first four scales. Dorsal fin with 9 rays and the anal with 6 rays, the first ray being very short (less than one-half
the length of the second ray). Dark olive brown dorsally fading to silvery laterally and ventrally. A weakly defined plumbeous lateral band extending the full length of the body and caudal peduncle.

Paratypes.— Three series of specimens (LSUMZ 6299, 6301, 6307), collected at Blados, Santa María del Río, and Laguna de las Rusías in San Luis Potosí, México. Standard length 17-49 mm. Maximum depth of body contained 3.3-3.9 times in the standard length and the length of the head 3.5-4.1 times. Diameter of the eye contained 4.1-4.8 times in the length of the head. Lateral line restricted to the first 3-12 scales of the longitudinal series of 35-39 scales. Dorsal fin with 9 rays and the anal with 8 rays. Coloration the same as for the holotype except that the males in breeding condition are bright greenish-gold dorsally and yellowish-gold laterally and ventrally.

This form differs from the nominate form in the greater number of scales in a longitudinal series (35-39 against 32-35), the smaller size of the eye (4.1-4.8 times against 3.8-4.3 times in the length of the head), smaller head (3.5-4.1 against 3.3-3.6 times in the standard length), deeper body (3.3-3.9 against 3.9-4.3 times in the standard length), and the heavier caudal peduncle (depth of the peduncle contained in its length 1.7-2.1 times against 2.3-2.7 times).

Range.— The range for the species includes the Río Lerma basin and the headwaters of the Río Santa María, but the range of the present subspecies is limited to the headwaters of the Río Santa María.

Distribution in San Luis Potosí.— Limited to the Río Santa María and associated waters from Santa María del Río and above.
Specimens examined.— Bledos, Santa María del Río, and Laguna de las Rusias.

Other collection records.— Meek's specimens from Jesús María are presumably of the same subspecies.

Natural history.— This species appears to be an omnivorous bottom feeder as the contents of the digestive tract were found to consist of plant detritus, small aquatic invertebrates, and considerable amounts of inorganic bottom materials. The breeding season extends throughout the late spring and summer.

Remarks.— Even though this form does not interbreed with *Notropis calientis calientis*, simply because there is no overlap of the ranges of the two forms, the differences between them do not seem to be sufficient to produce reproductive isolation if they were in contact.

NOTROPIS LUTRENSIS FORLONENSIS MEEK


Type locality.— Forlón, Tamaulipas, México.

Description.— Maximum depth of body contained 3.7-4.0 times and the length of the head contained 3.6-4.1 times in the standard length. Diameter of the eye contained 2.8-3.2 times in the length of the head. Dorsal fin with 9-10, usually 9, rays and the anal with 10-11, usually 10, rays. Lateral line with 32-35 scales.

Dorsal surface pale olive green and the lateral and ventral areas
silvery. A faint plumbeous band extends from the eye to the small black caudal spot. This lateral band is most prominent on the caudal peduncle and very faint on the body. All of the fins are essentially colorless.

**Range.**—Lower Pánuco basin.

**Distribution in San Luis Potosí.**—Limited to the streams of the lowlands and foothills.

**Specimens examined.**—Valles, Naranjos, and Tamazunchale.

**Other collection records.**—Río Axtla at Axtla, Río Moctezuma 2 mi. SW of Tamazunchale (UMMZ).

**Natural history.**—This species feeds on small invertebrates, primarily insect larvae, that are apparently taken on the bottom as considerable grainy material is often found in the digestive tract. Meek (1904) gives the breeding season as late May.

**Family AMEIURIDAE**

**PILODICTIS OLIVARIS (RAFINESQUE)**


**Type locality.**—Ohio River.

**Description.**—For the three specimens that I collected in a single locality the following counts and proportion hold: standard length 37.5–98.2 mm. The maximum depth of the body contained 5.0–5.1 times in the standard length and the length of the head contained 2.8–3.1 times. The diameter of the eye contained 6.5–8.5 times in the
length of the head and the interorbital width 2.6-2.9 times. Dorsal fin with the single spine followed by 5-6 soft rays and the anal with 14-15 rays.

Medium yellow-brown dorsally and light yellow-brown ventrally. Strongly mottled with darker brown both dorsally and ventrally. The fins very dusky with the margins white.

Range.— From the Ohio River south to the Río Pánuco.

Distribution in San Luis Potosí.— Apparently distributed throughout the lowlands and foothills (it seems to be known by the natives in these areas), but less common than Ictalurus punctatus.

Specimens examined.— Río Choy at Rancho Colandria.

Natural history.— The contents of the digestive tracts of the three specimens examined consisted of detritus.

Remarks.— This species is not considered a catfish (bagre) by the natives, but is known by a name I can best indicate by the phonetic ma-key-quan.

ICTALURUS FURCATUS (LE SUEUR)


Type locality.— New Orleans, Louisiana.

Description.— For the single specimen collected at Tamazunchale in the Río Amajaqui the data is as follows: standard length 370 mm. Maximum depth of the body contained 5.1 times in the standard length and the length of the head 3.4 times. Diameter of the eye contained
8.1 times in the length of the head, the length of the snout 2.2 times, and the least interorbital width 1.6 times. Dorsal fin with one stout spine followed by 6 soft rays and the anal with 33 rays.

Dark blue-gray dorsally and white ventrally. Fins blue-gray with the pelvics, anal, and caudal strongly suffused with red.

**Range.**—From Iowa and Ohio south to the Río Pánuco.

**Distribution in San Luis Potosí.**—Definitely recorded only from Tamazunchale, but apparently present in small numbers in the larger streams of the foothills and lowlands, as the natives in many localities are familiar with the species by the name of bagre azul.

**Specimens examined.**—Single specimen from the Río Amajaqui at Tamazunchale.

**Other collection records.**—Six specimens recorded from the Río Moctezuma at Tamazunchale (UMMZ).

**ICTALURUS MEXICANUS (MEEK)**


**Type locality.**—Rascón, San Luis Potosí, México.

**Description.**—Maximum depth of the body contained 4.2-5.3 times and the length of the head contained 3.1-3.6 times in the standard length. Diameter of the eye contained 4.8-6.7 times in the length of the head. Dorsal fin with the single heavy spine followed by 6 rays and the anal with 20-25 rays. Dark olive brown dorsally and light olive brown ventrally. All of the fins dark olive brown.
Range.— Restricted to the Panuco basin.

Distribution in San Luis Potosí.— This species ranges from the lowland streams to the eastern edge of the plateau. It is apparently rare in the lowlands and fairly common in the high mountain and eastern plateau regions.

Specimens examined.— La Media Luna and El Salto.

Other collection records.— Tamazunchale (UMMZ). Rascón (Meek).

Natural history.— This is one of the catfishes living in stream channels where the current is slight to moderate. It is omnivorous as the stomach contents include plant material, molluscs, insects, and small fish.

Remarks.— There is a single record for the form in the lowlands at Tamazunchale (UMMZ). I suspect that a critical examination of the species formerly assigned to the genus Ameiurus in México would reveal that the many nominal species are but slight variations of a single species. From the distribution of the catfishes in San Luis Potosí, it would seem that Ictalurus mexicanus is the oldest form in the state and now exists predominantly in parts of the state where competition from Ictalurus punctatus is held to a minimum by barriers that tend to prevent entry of the latter form.

ICTALURUS PUNCTATUS (RAFINESQUE)


Type locality.— Ohio River.

Description.— Maximum depth of the body contained 4.4-5.0 times
and the length of the head contained 3.6-4.0 times in the standard length. Diameter of the eye contained 4.1-4.5 times in the length of the head. Dorsal with the single stout spine followed by 6 rays and the anal with 25-30 rays.

Steel gray to medium olive green dorsally and white ventrally. Often with small black spots scattered at random on the dorsal and lateral surfaces. Dorsal fin the same color as the dorsal surface. Pectoral, pelvic, anal, and caudal fins pale reddish-brown. Dorsal, anal, and caudal fins frequently margined with black.

Range.— Streams draining into the Gulf of Mexico from the Río Pánuco northward, and north to the Great Lakes in the Mississippi Valley.

Distribution in San Luis Potosí.— Streams in the lowlands and foothills, and the lower Río Verde and middle Río Santa María.

Specimens examined.— Arroyo Largatija, Puente de Dios, Río Axtla 2 mi. E of Axtla, Río Claro, Valles, Tanlacú, Tamazunchale, Arroyo Huichi.

Natural history.— An omnivorous species inhabiting the channels and deeper pools of the large streams and the lower parts of smaller tributaries.

Family CYPRINODONTIDAE

UNDSCRIBED GENUS AND SPECIES

A form belonging to a previously unknown genus, apparently most closely related to the genus Cyprinodon, was collected at La Media Luna. Dr. Robert R. Miller is preparing descriptions for the genus and species.

In the collections of the Louisiana State University Museum of Zoology there is a single series from Laguna Ebano, consisting entirely of very small individuals (the largest individual does not exceed 20 mm. in standard length). Dr. Robert R. Miller, Associate Curator of Fishes of the University of Michigan Museum of Zoology, in personal correspondence makes the following comments concerning this series:

"Although the specimens are not really adequate for positive identification there is no question in my mind that they belong to the variegatus series, and I would tentatively identify them as Cyprinodon variegatus. They agree with that species in the following characters: (1) The scapular scale is much enlarged; (2) the pectoral fins are long and narrow; (3) there are numerous scales in the series around the body; (4) the dorsal fin is anterior in position; (5) the pelvic fins have 7 rays and are relatively long; (6) there are numerous gillrakers (25 on one counted); (7) the scales in the lateral series (what would correspond to those in the lateral line) are large, 24 in 4, 25 in 5, and 26 in 1, out of 10 counted; and (8) the first dorsal ray is rather heavy and spine-like. Comparison with a collection of C. variegatus from 64 miles south of Tampico, along the coast, shows that the Ebano sample differs in coloration, a slenderer body, and in having the preorbital region not quite as well scaled. Whether some or all of these characters are responses to a freshwater habitat or not is problematical. Probably the Ebano population bears a relationship to variegatus similar to that of Cyprinodon hubbsi of certain freshwater lakes in Florida."
The Ebano Cyprinodon obviously has little to do with the interior species of Cyprinodon in northeastern Mexico and bears no close relationship to the new genus from La Media Luna."

Family GOODEIDAE

ATAENIOBIUS TOWERI (MEEK)


Type locality.—Rio Verde, San Luis Potosí, México.

Description.—Maximum depth of the body contained 3.1-3.5 times in the standard length and the length of the head 3.8-4.2 times. The diameter of the eye contained 2.7-3.7 times in the length of the head and the minimum depth of the caudal peduncle 1.7-1.8 times. Dorsal fin with 10-12 rays and the anal with 11-13 rays, the first 6 or 7 developed as a separate copulatory lobe in the males. Longitudinal series with 38-45 scales.

Dark olive brown dorsally and medium olive green ventrally. All the fins dark olive green. Very young individuals with irregular x-shaped black markings on the dorsal and lateral surfaces.

Range.—Limited to its distribution in San Luis Potosí.

Distribution in San Luis Potosí.—Limited to that portion of the Río Verde and its associated waters found in the Río Verde Valley.

Specimens examined.—La Media Luna, Puerta del Río, and the Río Verde at Río Verde.
Natural history.— Apparently this species requires stable conditions and seems to prefer quiet waters of a depth not over five feet. It feeds on plant detritus and algae. In females 38-63 mm. in standard length that I have examined the number of young was 8-17.

Remarks.— When one considers the ever increasing arc of distribution to the south and west of the family Goodeidae as one progresses from the most primitive subfamily (Ataeniobiinae) to the most advanced subfamily (Girardinichthyinae), the area now occupied by A. toweri when it was at the headwaters of the Lerma system seems to be the logical candidate for the site of origin of the family.

XENOTOCA VARIATA (BEAN)


Type locality.— Guanajuato, México.

Description.— Maximum depth of body contained 2.6-3.4 times in the standard length, length of the head 3.0-3.4 times, and the minimum depth of the caudal peduncle 6.0-7.3 times. Dorsal fin with 11-14 rays and anal with 13-15 rays, male with first 6, or rarely 7, modified into a copulatory lobe. Diameter of the eye contained 2.9-3.7 times in the length of the head and the minimum depth of the caudal peduncle 1.9-2.2 times. Longitudinal series with 33-36 scales.

Male dark olive brown on the dorsal surface and blending to dark gray-blue on the upper lateral surfaces of the body and the lateral surface of the caudal peduncle. Abdomen silvery and weakly suffused
with orange. Lateral and ventral surfaces of the head silvery with the ventral surface strongly suffused with orange. Abdomen also silvery and strongly suffused with orange. Pectoral, pelvic, and anal fins are orange, while the dorsal fin is dark olive brown and faintly margined with orange. Caudal fin with the basal two-thirds black and followed by a wide band of orange and a narrow white margin. A dark lateral band of varying degrees of intensity and regularity extending from the opercular angle to the base of the caudal fin. Dorsal and lateral surfaces irregularly spotted with black and showing a great amount of iridescence. The general coloration of the female is similar to, though paler than, that of the male. The dark lateral band is lacking; the black spots are more numerous, larger, and more intensely pigmented; and the caudal fin is orange-brown and lacks the black on the base.

Range.— The Río Lerma basin in Guanajuato, Queretaro, Jalisco, and Aguascalientes, and the upper Río Santa María drainage in San Luis Potosí.

Distribution in San Luis Potosí.— This species is found in the headwaters of the Río Santa María from the vicinity of Santa María del Río and above. It has been reported erroneously from Río Verde and Rascón as a result of confusion in connection with records from the Río Verde in Aguascalientes.

Specimens examined.— Santa María del Río, Laguna de las Rusias, and Bledos.

Natural history.— This species feeds on detritus and prefers ponds, lakes, or deeper, relatively currentless pools in the streams.
Meek (1904) gives the breeding season as the last of May, but evidence from specimens examined indicates that the breeding season must extend at least into August. Females 37-59 mm. in standard length were found to contain 9-46 young with the largest of these being 13 mm. in standard length.

**GOODEA GRACILIS** HUBBS AND TURNER


**Type locality.**—Río Santa María at Santa María del Río, San Luis Potosí, México.

**Description.**—Maximum depth of body contained 2.9-3.7 times in the standard length, length of the head contained 3.1-3.9 times, and the minimum depth of the caudal peduncle contained 5.5-6.6 times. Diameter of the eye contained 3.3-4.6 times and the minimum depth of the caudal peduncle contained 1.5-1.8 times in the length of the head. Dorsal fin with 12-14 rays and the anal with 14-16 rays. Longitudinal series with 35-39 scales.

Dark olive green dorsally and laterally. Abdomen and lower parts of the head pale olive green, strongly suffused with orange in the males and weakly suffused with orange in the females. Pectoral, as well as the pelvic fins, pale orange. The dorsal, anal, and caudal fins are olive green. Young individuals are paler and tinged with buff. In addition, they show irregular black x-shaped markings on the dorsal and lateral surfaces.
Range.— Upper Río Santa María drainage and the Río San Juan, a tributary of the Río Moctezuma, in Queretaro.

Distribution in San Luis Potosí.— Limited to the Río Santa María and associated waters from Santa María del Río upstream.

Specimens examined.— Santa María del Río, Laguna de las Rusias, Bledos.

Natural history.— As is true of the other goodeids found in San Luis Potosí, this form prefers lakes, ponds, and the deeper pools of the streams. It feeds on plant materials. Breeding occurs throughout the spring and summer and may extend throughout the year. In females 49–74 mm. in standard length that I have examined, the number of young is 11–62. In a single female some of the young may be at least twice as large as others, possibly indicating superfetation.

Remarks.— The disjunctive range of Goodea gracilis, which is found only in limited areas of the upper Río Santa María and the Río San Juan (widely separated tributaries of the Río Pánuco), is an interesting problem and seems to have several possible solutions. On the basis of the present distribution of the family Goodeidae, it seems necessary to postulate that this range is the result of dispersion through the Río Lerma system rather than the Río Panuco system. Thus, G. gracilis either has arisen by parallel evolution of allopatric populations or is a static ancestral form on the periphery of the range of the genus — a form that has been replaced in the central part of the range by related forms.

Among specimens 28–78 mm. in standard length, even in topotypic
material, I fail to find any individuals with the caudal peduncle as slender as the least slender (minimum depth of the caudal peduncle contained 1.75 times in the length of the head) indicated by Hubbs and Turner (1939).

**XENOPHORUS CAPTIVUS CAPTIVUS (HUBBS)**


**Type locality.**— Jesús María, San Luis Potosí, México.

**Description.**— Maximum depth of body contained 2.3-3.6 (males 2.3-3.2, females 2.5-3.6) times in the standard length, length of the head 2.9-4.0 (males 2.9-3.6, females 3.1-4.0) times, and the distance from the origin of the anal fin to the base of the caudal 2.3-3.1 (males 2.3-3.0, females 2.3-3.1) times. Minimum depth of the caudal peduncle contained 1.7-2.3 times and the diameter of the eye 3.4-4.4 times in the length of the head. Dorsal fin with 12-14 rays and the anal with 13-15 rays. Pectoral fins with 13-15 rays, not including the rudimentary uppermost ray. Scales 32-39 in a longitudinal series.

Larger males blue-black with darker scale margins dorsally. Laterally the centers of the scales are strongly iridescent with green, yellow, and light blue, depending on the angle of lighting, and the scale margins are olive green. The lower portions of the head and body are silvery and strongly suffused with orange. The basal two-thirds of the dorsal and caudal fins are dusky with the border pale orange in the caudal and whitish in the dorsal. The anal and pelvic fins are entirely pale orange and the pectorals are dusky throughout their length.
The female differs in having the dorsal surface brown and the lateral iridescence trending more strongly to yellow and blue. The duskiness on the dorsal and caudal fins is more restricted and less pronounced.

The smaller individuals of both sexes are paler, less iridescent, and irregularly spotted with x-shaped black markings. In the smaller males there is in addition a broad lateral band of black. These black markings become more and more obsolete as the individual increases in size and are entirely lacking in most large individuals.

Range. — Same as its distribution in San Luis Potosí.

Distribution in San Luis Potosí. — Restricted to the headwaters of the Río Santa María from the vicinity of Santa María del Río and above.


Natural history. — This form feeds primarily on plant detritus, but occasional insect larvae are found in the contents of the digestive tract. As in the other goodeids in the state, the preferred habitat is lakes, ponds, and the deeper, relatively currentless pools in streams. Females 35-53 mm. in standard length contained 9-26 embryos with the largest embryos being 19 mm. in total length.

Remarks. — Within Xenoophorus captivus captivus I include the population from Jesús María originally described by Hubbs as Goodea captiva and later placed in the genus Xenoophorus by Hubbs and Turner, the population from Santa María del Río originally described by Hubbs and Turner as Xenoophorus erro, and two previously unreported populations
from Laguna de las Rusias and Bledos.

Reasons for assigning these four allopatric populations to the same subspecies are as follows: (1) The degree of difference between the various populations when statistically analyzed is not sufficient to justify subspecific status when compared to standards recommended by Hubbs and Perlmutter (1942), by Hubbs and Hubbs (1953), and by Mayr, Linsley, and Usinger (1953). In general the degree of difference between the various populations is less than half that noted for the polytypic genera and species within the family. (2) There are no differences in ovarian and trophotaenial characters as noted for the polytypic genera and species within the family. (3) Habitat requirements for the four populations are essentially the same. (4) The isolation of these populations is a recent event (possibly within historical times) and in most cases may possibly be removed during extremely rainy periods. With this in mind, it would seem that if two or more species were involved they would be represented by reproductively isolated populations at the same locality.

The average and range for several characters in the four populations are as follows: Length of the head contained in the standard length 3.18 (2.9-3.6) in males and 3.44 (3.1-3.9) in females from Santa Marfa del Río, 3.31 (3.2-3.5) in males and 3.53 (3.3-3.8) in females from Jesús Marfa, 3.22 (3.0-3.5) in males and 3.60 (3.3-3.9) in females from Laguna de las Rusias, and 3.21 (3.0-3.5) in males and 3.63 (3.3-4.0) in females from Bledos. Maximum depth of the body contained in the standard length 2.61 (2.3-3.2) in males and 2.83 (2.5-3.3) in females from Santa
Marfa del Río, 2.74 (2.5-3.1) in males and 3.00 (2.8-3.2) in females from Jesús Marfa, 2.76 (2.5-3.0) in males and 3.05 (2.8-3.2) in females from Laguna de las Rusias, and 2.92 (2.8-3.2) in males and 3.07 (2.6-3.6) in females from Bledos. Minimum depth of the caudal peduncle contained in the length of the head 1.95 (1.8-2.3) in males and 1.98 (1.7-2.3) in females from Santa Marfa del Río, 1.94 (1.8-2.1) in males and 2.00 (1.9-2.2) in females from Jesús Marfa, 1.99 (1.8-2.2) in males and 2.02 (1.9-2.2) in females from Laguna de las Rusias, and 1.93 (1.8-2.1) in males and 1.94 (1.7-2.2) in females from Bledos. Distance from the origin of the anal fin to the base of the caudal contained in the standard length 2.59 (2.3-3.0) in males and 2.72 (2.5-3.1) in females from Santa Marfa del Río, 2.56 (2.3-2.9) in males and 2.69 (2.5-3.0) in females from Jesús Marfa, 2.48 (2.3-2.6) in males and 2.68 (2.4-2.9) in females from Laguna de las Rusias, and 2.44 (2.3-2.6) in males and 2.65 (2.3-2.9) in females from Bledos. The pectoral fins with 13-15 rays (13 for 3%, 14 for 53%, and 15 for 44%) in specimens from Santa Marfa del Río and Jesús Marfa, 14-15 rays (50% for each) in specimens from Laguna de las Rusias, and 13-15 rays (13 for 19%, 14 for 66%, and 15 for 15%) in specimens from Bledos. The degree to which the dorsal profile anterior to the dorsal fin becomes sigmoid in mature males is subject to considerable variation even among individuals of the same size from the same population. However, in some of the largest and deepest bodied males from Santa Marfa del Río the sigmoid shape of this profile is much more pronounced than in any individuals from the other localities.
Publ., 42, 1939: 54, pl. 5, fig. 3.

Type locality.— Agua del Medio, San Luis Potosí, México.

Description.— Maximum depth of body contained in the standard length 2.5-3.3 (average 2.89) times in males and 2.8-3.2 (average 3.02) times in females. Length of the head contained in the standard length 3.0-3.4 (average 3.16) times in males and 3.1-3.6 (average 3.38) times in females. The distance from the origin of the anal fin to the base of the caudal contained in the standard length 2.4-2.8 (average 2.63) times in males and 2.5-3.0 (average 2.75) times in females. Minimum depth of the caudal peduncle contained in the length of the head 2.0-2.4 (average 2.25) times in males and 2.1-2.8 (average 2.30) in females. Diameter of the eye contained 3.0-3.9 times in the length of the head.

Dorsal fin with 12-14 rays, anal with 14-16 (rarely 16) rays, and the pectorals with 12-15 (rarely 12 or 15) rays. Scales 34-39 in a longitudinal series.

Coloration as in Xenoophorus captivus captivus, but with the black markings more pronounced in moderate-sized individuals, the iridescence of the lateral surfaces trending more strongly to blues, and the ventral surfaces less strongly suffused with orange.

Range.— Coincides with the distribution in San Luis Potosí.

Distribution in San Luis Potosí.— Limited to a small system of spring-fed streams near the northern end of the San Luis Potosí Valley.

Specimens examined.— Moctezuma.
Other collection records.— Agua del Medio and Venado (UMMZ).

Natural history.— The food habits and habitat preference are essentially the same as those of *Xenoophorus captivus captivus*. Females 32-40 mm. in standard length were found to contain 5-14 embryos, with the largest of these being 17 mm. in total length.

Remarks.— Of the various differences noted between this form and the populations from the southern end of the range of the genus, only the difference in the depth of the caudal peduncle (1.43 standard deviations without overlap or 92% separation) is as great as the generally proposed levels for subspecific difference (0.675 S.D. and 75%, 1.0 S.D. and 84%, and 1.28 S.D. and 90%). The other differences are all below 0.45 S.D. without overlap and 67% separation. However, by combining all of the independent differences, one should be able theoretically to separate this form with about 95% accuracy.

In view of the degree and type of difference, the similarity of food and habitat preference, and the lack of ovarian and trophotaenial differences, it seems more appropriate to designate this form as a subspecies rather than a full species.

The unique distribution of *Xenoophorus captivus exsul* (the only form known from the area it inhabits) is quite puzzling. Its presence at Venado and Moctezuma could possibly be accounted for by introduction, though no record of such exists, but it seems highly unlikely that introduction could account for its presence at Agua del Medio. This form probably represents a remnant of a Pleistocene lake fauna once inhabiting the entire San Luis Potosi Valley that has become differentiated from the other representative of the genus during a long period of time.
Family POECILIIDAE

GAMBUSIA AFFINIS (BAIRD AND GIRARD)


Type locality.— Río Medina and Río Salado, Texas.

Description.— Maximum depth of body contained in the standard length 3.3-4.6 (3.8-4.4 in males, 3.3-4.6 in females) times. Length of the head contained in the standard length 3.5-4.1 (3.9-4.1 in males, 3.5-3.7 in females) times. Diameter of the eye contained in the length of the head 3.0-3.9 (3.0-3.2 in males, 3.6-3.9 in females) times. The minimum depth of the caudal peduncle contained in the length of the head 1.3-1.9 (1.3-1.5 in males, 1.8-1.9 in females) times. Dorsal fin with 6 rays and the anal with 8-9 rays. Scales 28-30 in a longitudinal series.

Olive green dorsally with the scale margins darker. Silvery ventrally. Dorsal and caudal fins with rows of small black spots.

Range.— Atlantic and Gulf drainages from New Jersey to Alabama (Gambusia affinis holbrooki), southern Indiana and Illinois south in the Mississippi Valley and along the Gulf coast to the Río Pánuco (G. a. affinis), and the Río Grande drainage in Texas and northeastern México (G. a. speciosa).

Distribution in San Luis Potosí.— Apparently limited to the coastal plains area.

Specimens examined.— Laguna Ebano and Arroyo Huichi.
Natural history.— This form feeds on small insects and larvae and is found along the edges of the smaller streams and lakes.

Remarks.— Of the three nominal subspecies within the species, the specimens from San Luis Potosí seem to correspond most closely with Gambusia affinis affinis on the basis of gonopodial characters and the dorsal fin ray count.

GAMBUSIA AXTLA new species

Holotype.— A mature male (LSUMZ 6389) 25.6 mm. in standard length, collected June 19, 1954, in the Río Axtla at the ferry to Xilitla in San Luis Potosí, México. Maximum depth of body contained 4.6 times in the standard length and the length of the head contained 3.8 times. The diameter of the eye contained 2.8 times in the length of the head, the length of the snout 3.1 times, the least interorbital width 2.5 times, and the minimum depth of the caudal peduncle 1.7 times. Dorsal fin with 8 rays and the anal with 10 rays. Longitudinal series with 31 scales.

Olive green dorsally and silvery ventrally. The top of the head black and this color extending to the base of the caudal fin as a fairly wide mid-dorsal line. A rather diffuse black lateral band extending from the upper margin of the operculum to the base of the caudal fin. The scale margins are dark with the intensity decreasing on the ventral portion of the caudal peduncle and the dark margins almost disappearing completely on the abdomen. There is a narrow mid-ventral black line on the caudal peduncle. The dorsal portion of the body has prominent black spots which tend to form longitudinal rows, particularly on the row of
scales immediately above the lateral band. The dorsal fin bears a row of black spots about one-third of the way up from its base and has a wide black margin. The anal fin is dusky basally and has a rather prominent black spot on the posterior part of its base. The caudal fin has a narrow vertical black line at its base, is dusky basally, and is completely margined with black, the upper and lower margins being continuations of the black mid-dorsal and mid-ventral lines of the caudal peduncle.

Paratypes.—A large series of paratypes (LSUMZ 6390) was secured along with the holotype and additional small series (LSUMZ 2609, 6394) were secured near Matlapa and near Huichihuayán in a tributary of the Rio Axtla. In these series the maximum depth of the body is contained in the standard length 4.6-4.8 times in males and 3.6-4.5 times in females. The length of the head is contained in the standard length 3.8-4.1 times in males and 3.5-3.9 times in females. The diameter of the eye is contained in the length of the head 2.6-3.1 times, the length of the snout 2.6-3.1 times, the least interorbital width 2.0-2.6 times, and the minimum depth of the caudal peduncle 1.7-1.9 times in the males and 2.0-2.2 times in the females. The dorsal fin constantly with 8 rays and the anal with 9-10, rarely 9. Longitudinal series with 31-32 scales.

The gonopodial characters of the males clearly indicate a close relationship with Gambusia senilis and Gambusia nobilis. However, there are a number of ways in which the gonopodium differs from that of the related species. The serrae of the posterior branch of ray four are very weakly developed, usually limited to two or three very short and
rather blunt spines. The hooked terminal segments of the posterior branch of ray four and the anterior branch of ray five are about one and one-half times as long as in the related species and more sharply hooked. The spines of ray three proximal to the level of the elbow are shorter and less erect, causing a smooth blending of the anterior margin of the gonopodium into the region bearing the long distal spines rather than forming a notch at the level of the elbow as in *G. senilis* and *G. nobilis*. The posterior border of ray five is strongly serrated, particularly in the more basal part.

In general body conformation this species is much more slender than the other two members of the complex and has the dorsal profile anterior to the dorsal fin forming a nearly straight line rather than a double curve. The eye is larger (2.6-3.1 times in the length of the head against 3.1-3.6 times for *G. nobilis* and 2.9-3.7 times for *G. senilis*), the head is narrower (least interorbital width contained 2.0-2.6 times in the length of the head against 1.9-2.2 for *G. nobilis* and *G. senilis*), and the snout is longer (2.6-3.1 times in the length of the head against 2.9-3.4 for *G. nobilis* and *G. senilis*) and more pointed.

**Range.**—Apparently limited to the area of its distribution in San Luis Potosí.

**Distribution in San Luis Potosí.**—Apparently limited to the basin of the Río Axtla (as is true for *Xiphophorus pygmaeus*) since all the specimens were taken in this drainage.
Specimens examined.— Río Axtla at the ferry to Xilitla, Río Huichihuayán 2 km. SW of Huichihuayán, Río Matlapa 1 mi. N of Matlapa.

Natural history.— This species inhabits relatively quiet waters and feeds on small insects. In females 19-34 mm. in standard length that I have examined the number of young was 1-8.

GAMBUSIA PANUCO HUBBS


Type locality.— Río Valles at Valles, San Luis Potosi, México.

Description.— Maximum depth of body contained 3.7-4.8 times in the standard length (gravid females the heaviest and males the most slender) and the length of the head 3.5-4.1 times. Diameter of the eye contained 2.8-3.6 times in the length of the head, length of the snout 2.9-3.4 times, interorbital width 2.2-2.7 times, and the minimum depth of the caudal peduncle 1.3-2.0 times. Length of the depressed dorsal fin contained 1.4-1.8 times in the distance from the origin of the dorsal fin to the base of the caudal. Length of the upper lip contained 0.31-0.44 times in its width. Dorsal fin with 7 rays and the anal with 9-10, usually 9. Longitudinal series with 29-32 scales.

Olive green dorsally and silvery ventrally. Top of the head and the mid-dorsal line much darker. A narrow mid-ventral black line on the caudal peduncle. Dorsal and caudal fins usually with rows of black spots and a dusky margin. The intensity of the markings on the dorsal and caudal fins is variable and at times they are completely lacking.
There is a diffuse dark lateral band, which is more intensely pigmented and narrower in the male. The intensity of the lateral band is also quite variable.

Range.—Lower part of the Pánuco basin.

Distribution in San Luis Potosí.—Limited to the streams of the lowlands and foothills, and the Río Frío in the Sierra Madre Oriental.

Specimens examined.—Río Axtla at ferry to Xilitla, Valles, Arroyo Largatija, Rascón, Tamazunchale, Río Matlapa 1 mi. N of Matlapa, Río Choy at Rancho Colandria, Arroyo Huichí, and Laguna Ebano.

Other collection records.—Río Axtla at Axtla, Arroyo Plan de Jalpilla, Arroyo Santa Isabel (UMMZ).

Natural history.—This form inhabits relatively quiet waters and feeds on insects. In females 21-31 mm. in standard length that I have examined the number of young was 2-8. The finding of gravid females in the spring, summer, and winter indicates that this species may breed throughout the year.

Remarks.—The principal differences between Gambusia panuco and G. regani seem to be coloration and the number of rays in the anal fin. G. panuco is supposed to have 9 rays and G. regani is supposed to have 10 anal rays. In specimens from the more western part of the range of G. panuco the number of rays is constantly 9, but in specimens from the eastern part of the range in San Luis Potosí the number of rays is 9 or 10, with the proportion of individuals with 10 anal rays increasing as one moves eastward. In addition to the difference in the number of rays, the serrae of the posterior branch of ray four in the gonopodium are
supposed to be entirely proximal to the elbow in *G. regani* and opposite the elbow distally in *G. panuco*. However, in all specimens that I have examined from the collections at Tulane University and the University of Michigan that were assigned to *G. regani* the serrae are opposite the elbow distally. *G. regani* is generally lighter and has a darker, less diffuse, lateral band. In addition, *G. regani* lacks the dark markings on the dorsal and caudal fins that are found in *G. panuco*. However, the variation of coloration in specimens in San Luis Potosí has already been pointed out in the description and the farther to the east one passes the more closely the specimens resemble *G. regani* in coloration.

I believe that *G. regani* and *G. panuco* may represent offspring of a common ancestral form that entered the present Pánuco basin when the Río Tamesí was a separate drainage emptying into the Gulf, but did not attain reproductive isolation before the Río Tamesí became a tributary of the Río Pánuco during a period of coastal emergence. Thus, there are rather distinct differences between the form of the middle Moctezuma and Santa María basins and the form of the middle Tamesí basin, but a broad region of overlap with intermediate forms occurs in the lower Pánuco basin.

There are two lots of San Luis Potosí specimens (UMMZ) from Tamazunchale and the Río Valles 7 miles west of Nuevo Morelos assigned to *G. regani* according to records furnished by Dr. Robert R. Miller, but I do not have any specimens that I would not assign to *G. panuco* or possibly intergrades between *G. panuco* and *G. regani*. 

Type locality.— Forlón, Tamaulipas, México.

Description.— Maximum depth of body contained 3.1–4.8 times and the length of the head contained 3.5–4.1 times in the standard length. Diameter of the eye contained 2.5–3.0 times and the minimum depth of the caudal peduncle contained 1.5–2.1 times in the length of the head. Dorsal fin with 8 rays and the anal with 9–10, rarely 9, rays. Longitudinal series with 28–31 scales. In gonopodial characters this species closely resembles Belonesox belizanus. Rays three, four, and five curve anteriorly at the level of the elbow and posteriorly distal to the elbow, giving the distal part of the gonopodium somewhat of the form of a sigmoid curve. Ray three lacks the well-developed spines found opposite the elbow in B. belizanus. The anterior branch of ray four has an elbow much like that of B. belizanus (formed by processes of the segments projecting distally at an acute angle, not at a right angle as in the other species of Gambusia). The posterior branch of ray four bears serrae that are opposite the elbow distally. Generally there are 3 large spines, but occasionally there are one or two additional small spines proximal to the large spines. The branch terminates in an elongated, weakly hooked, segment, as does the anterior branch of ray five. The posterior branch of ray five becomes abruptly more slender at a level about 3 or 4 segments beyond the end of ray six and it terminates just distal to the serrae.
Pale olive green dorsally and becoming somewhat suffused with pale gray-blue laterally. The abdomen and ventral portion of the head are white. The wide lateral band, which in preserved specimens appears black, is dark plumbeous colored in living specimens. The dorsal and caudal fins have a dusky to black margin and occasionally a single row of spots that are nearer the base than the margin. Caudal fin with a faint narrow lunate line of black at the very base. The scale margins are somewhat darker dorsally and form a reticulate pattern.

**Range.**—Apparently limited to the Pánuco basin.

**Distribution in San Luis Potosí.**—Limited to the streams of the lowlands and foothills.

**Specimens examined.**—Arroyo Largatija, Valles, Río Choy at Rancho Colandria, Arroyo Huichí, El Nacimiento del Coy, Arroyo Matlapa at Matlapa, Arroyo Palitla at Palitla, Tamazunchale, Río Claro, Río Axtla at the ferry to Xilitla.

**Other collection records.**—Arroyo Plan de Jalpilla, Axtla (UMMZ).

**Natural history.**—This form is abundant in streams with little current and rocky or gravel bottoms. It feeds almost exclusively on diatoms, apparently encrusting forms that are scraped from rocks. In females 19-29 mm. in standard length the number of young was 2-10.

**Remarks.**—Heckel's drawings and statistics for *Xiphophorus gracilis* indicate that *G. vittata* could not be the same species. As indicated by the gonopodial characters, *G. vittata* may be a northern derivative of the ancestral stock from which *Belonesox belizanus* was derived.

Type locality.— Lake Alcohuaca near Huamantla, Tlaxcala, México [= Lago de Aljojuca, Pueblo, México].

Description.— Maximum depth of body contained 3.3-4.0 times in the standard length, length of the head 3.5-3.8 times, and the minimum depth of the caudal peduncle 5.4-6.4 times. Diameter of the eye contained 2.8-3.4 times and the minimum depth of the caudal peduncle 1.4-1.8 times in the length of the head. Dorsal fin with 11-13 rays and the anal with 9-10. Depressed gonopodium reaching the base of the caudal fin.

Male olive brown dorsally with a reticulate pattern formed by the darker scale margins. Lateral surfaces of the body, lateral and ventral surfaces of the caudal peduncle, and the posterior part of the abdomen blue-gray with a fainter pattern of reticulations. Anterior part of the abdomen and the lower jaw white. An indistinct black band extending from the eye to a large black spot on the upper part of the terminal portion of the caudal peduncle and the base of the caudal fin. Pectoral, pelvic, and anal fins orange. The dorsal fin orange and irregularly spotted with black. The caudal fin is orange and irregularly spotted with black basally and is clear distally. The coloration of the female is similar, but the white covers the entire abdomen and the orange color of the fins is less intense.

Range.— Rivers draining into the Gulf from the Río Papaloapan in the south to the Río Pánuco in the north.
Distribution in San Luis Potosí.— Found in the streams of the lowlands and foothills. From its occurrence at El Salto in the Río Valles, I would suspect that it occurs in the Río Frío in the Sierra Madre Oriental, even though it has never been reported from this stream.

Specimens examined.— Arroyo Falitla at Falitla and El Salto.

Other collection records.— Arroyo Matlapa at Comoca, Río Axtla at Axtla, Río Matlapa at Matlapa, Arroyo Plan de Jalpilla, Río Moctezuma at Tamazunchale (UMMZ).

Natural history.— This species is an inhabitant of quiet waters that feeds on insects, to a large extent on terrestrial insects that fall into the water. Females 35-59 mm. in standard length that I have examined contained 6-31 young.

Remarks.— This species is much more abundant in the Río Moctezuma drainage than in the Río Santa María drainage.

MOLLINESIA SPHENOPS SPHENOPS (CUVIER AND VALENCIENNES)


Type locality.— Veracruz, México.

Description.— Maximum depth of body contained 2.5-3.5 times in the standard length, length of the head 3.0-4.1 times, and the minimum depth of the caudal peduncle 4.2-5.9 times. Diameter of the eye contained 2.7-3.6 times and the minimum depth of the caudal peduncle 1.1-1.6 times in the length of the head. Dorsal fin with 8-10, usually 9, rays and the anal with 8-9. Longitudinal series with 26-29 scales.
The coloration is quite variable. The dorsal surface is dark olive green and the lateral and ventral surfaces vary from pale olive green to light blue and yellow. In addition to the variation of the ground color, there are numerous variations of spotting on the lateral surfaces of the body and caudal peduncle and variations in the color of the dorsal and caudal fins. The most typical coloration for the breeding male is dark olive green dorsally, margins of the lateral scales pale yellow and their centers pale blue with a small central spot of red-brown, and the dorsal and caudal fins black basally and margined with a wide band of bright yellow. The most typical coloration of the female differs in having the sides more olive tinted and the dorsal and caudal fins pale olive green.

**Range.**—Rivers of the Gulf drainage from the vicinity of the city of Monterey in the north to the Río Papaloapán in the south.

**Distribution in San Luis Potosí.**—Found in all the streams of the lowlands and foothills and in the Río Frío.

**Specimens examined.**—El Salto, Río Axtla 2 mi. E of Axtla, Río Matlapa 1 mi. N of Matlapa, Arroyo Largatija, Valles, Arroyo Huichi, Río Axtla at the ferry to Xilitla, Rascón, Palitla, and Tamazunchale.

**Other collection records.**—Arroyo Plan de Jalpilla, Arroyo Matlapa at Comoca, Río Coy near Tancanhuitz (UMMZ).

**Natural history.**—This species inhabits relatively currentless waters and feeds on plant materials and occasional invertebrates. The breeding seems to occur throughout the year. In females 36–68 mm. in standard length that I have examined the number of young was 15–78.
XIPHOPHORUS MILLERI new species

Holotype.—A mature male (LSUMZ 6388), collected July 30, 1952, at El Nacimiento del Coy, San Luis Potosí, México. Standard length 37.6 mm. Maximum depth of body contained 2.7 times in the standard length, length of the head 4.1 times, and the minimum depth of the caudal peduncle 3.4 times. The dorsal fin with 14 rays that become progressively longer with an abrupt increase in length taking place between rays 10 and 11. The depressed dorsal reaching well beyond the base of the caudal fin. The anal fin with 9 rays, its length contained 5 times in the standard length. The extension of the caudal fin very slender, its length contained 1.3 times in the standard length. The diameter of the eye contained 2.8 times in the length of the head. Longitudinal series with 28 scales.

Dorsally the color is a medium olive green with the darker margins of the scales forming a reticulate pattern and tending to form two longitudinal stripes. In addition to the darker scale margins, the dorsal area is marked with black on the dorsal surface of the caudal peduncle and there is a black area covering the interorbital region and tapering to the origin of the dorsal fin. A plumbeous lateral band of about one scale's width extends from the tip of the snout to the base of the caudal fin. This band is separated from the area of dorsal coloration by a yellowish-green band about twice as wide. The lower lateral and ventral surfaces are yellowish-green. The fins are yellow. The dorsal fin is marked by a row of small black spots about one-fourth way up from its base and has a narrow dusky margin. The black on the
ventral surface of the caudal peduncle extends onto the ventral half of the caudal extension. There is no black border on the dorsal part of the caudal extension, but there is a large lunate black spot that covers the entire base of the caudal fin.

Paratypes.—Four males (LSUMZ 6265) were collected along with the holotype. These males, ranging from 27.3 to 41 mm. in standard length, show various degrees of immaturity. The range of depth of body is 2.6-2.9 times in the standard length, the length of the head 3.8-4.1 times, and the minimum depth of the caudal peduncle 3.7-4.3 times. The dorsal fin has 13 or 14 rays, usually 14. The anal fin has 9 rays and shows varying degrees of development. The diameter of the eye is contained 2.7-2.8 times in the length of the head. Longitudinal series with 27-28 scales. The caudal extension is lacking in all four individuals. The coloration is essentially the same as that of the holotype with some variation in the intensity of the black markings.

One additional mature male (LSUMZ 6264) 23.5 mm. in standard length was collected July 27, 1952, in the Río Choy at Rancho Colandria two miles west of Tamūin. This specimen agrees closely with the others except in depth of body, which is contained 3.2 times in the standard length.

The close relationship of this species with Xiphophorus pygmaeus is indicated by the gonopodial characters, which are within the normal range of variation of those of X. pygmaeus. However, in general body proportions this species more closely resembles Xiphophorus montezumae or Xiphophorus helleri.
Range.— Apparently limited to the Pánuco basin.

Distribution in San Luis Potosí.— This form might be expected in any of the clear tributaries in the foothills. However it may be limited to tributaries of the Río Santa María, as both the Río Coy and the Río Choy are tributaries of the Río Santa María. In addition, its distribution may be even more restricted since both of the localities where it has been collected are closely associated with large springs. The last possibility would correspond closely with the case of Xiphophorus couchianus.

Natural history.— This species seems to prefer deep water with little or no current, as all of the specimens were taken in very deep pools.

Remarks.— The species has been named in honor of Dr. Robert R. Miller, who has been most helpful in my studies of the fishes of San Luis Potosí.

XIPHOPHORUS MONTEZUMAE JORDAN AND SNYDER

Xiphophorus montezumae Jordan and Snyder, Bull. U.S. Fish. Comm., 1900: 131, fig. 11.

Type locality.— Río Verde [= Río Frío] near Rascón, San Luis Potosí, México.

Description.— Maximum depth of body contained 2.7-3.3 times in the standard length, the length of the head 3.7-4.7 times, and the minimum depth of the caudal peduncle 4.0-5.5 times. Diameter of the eye contained 2.5-3.6 times and the minimum depth of the caudal peduncle
0.9–1.5 times in the length of the head. Dorsal fin with 11–13 rays, usually 11 or 12, and the anal with 7–9, usually 8. Gonopodium about as long as the head. Longitudinal series with 26–29 scales. Caudal fin of the male with the lower rays extended to form a rather coarse pointed appendage of varying length.

The female is dark olive brown dorsally with darker brown scale margins producing a reticulate pattern. There are three contiguous lateral bands of equal width extending from the eye to the base of the caudal fin. The middle band is very dark brown and the others are light gray-blue. The abdomen, lower jaw, and the ventral half of the operculum are white, while the lower part of the caudal peduncle is light olive green. The pectoral, pelvic, and anal fins are very pale yellow. The dorsal and caudal fins are pale olive green. The dorsal is irregularly spotted and faintly margined with black, and the caudal often bears one or more large black spots basally. There are frequently black spots of varying size and number on the body and caudal peduncle.

The coloration of the male differs from that of the female in a number of ways. The dark brown lateral band is generally much less distinct, in fact, at times it is almost completely lacking. The gray-blue area is much more extensive, covering the lateral and ventral surfaces from the level of the origin of the dorsal fin to the base of the caudal fin. The dorsal fin is bright yellow and has the black markings more pronounced than in the female. The caudal fin, with the exception of the caudal appendage, is pale yellow. The caudal appendage is bright yellow and bordered above and below with black. The lower black border
of the caudal appendage is extended forward on the caudal peduncle as a narrow mid-ventral line.

**Range.**—Lower and middle portions of the Pánuco basin.

**Distribution in San Luis Potosí.**—This species is found in all the streams in the lowlands and foothills and in the Río Frío in the Sierra Madre Oriental.

**Specimens examined.**—Arroyo Palitla, Río Axtla at the ferry to Xilitla, El Salto, Valles, Tamazunchale, Río Frío near Rascón, and the Río Choy at Rancho Colandria.

**Other collection records.**—Río Axtla at Axtla, Río Matlapa at Matlapa and Comoca, Arroyo Plan de Jalpilla (UMMZ).

**Natural history.**—This form inhabits shallow waters with little or no current. The food consists primarily of plant materials, but an occasional small invertebrate is found in the contents of the digestive tract. Females 33–45 mm. in standard length that I have examined contained 4–25 young. The breeding season seems to extend throughout the year with the peak coming during the rainy season.

**Remarks.**—There are minor differences between the lowland populations and those of the Río Frío and the upper Río Valles, but I do not consider these differences to be of sufficient magnitude to justify subspecific differentiation of these allopatric populations. In the lowland population the head is larger (3.7–4.0 against 4.1–4.6 times in the standard length) and the eye is generally larger (2.5–3.2 against 2.9–3.4 times in the length of the head).
XIPHOPHORUS PYGMAEUS HUBBS AND GORDON

**Xiphophorus pygmaeus** Hubbs and Gordon, Copea, 1943: 31.

**Type locality.**— Río Axtla at Axtla, San Luis Potosí, México.

**Description.**— Maximum depth of body contained 3.4-3.9 times in the standard length, the length of the head 3.6-3.9 times, and the minimum depth of the caudal peduncle 5.3-6.1 times. Diameter of the eye contained 2.4-2.7 times and the minimum depth of the caudal peduncle 1.4-1.6 times in the length of the head. Dorsal fin with 9-12 rays, usually 10 or 11, and the anal with 7-9, usually 8 or 9. Longitudinal series with 23-26 scales.

Dark brown dorsally and buffy laterally and ventrally. A wide black band extending from the tip of the snout to the base of the caudal fin.

**Range.**— Limited to the basin of the Río Axtla.

**Distribution in San Luis Potosí.**— Found in the Río Axtla and its tributaries where the habitat is suitable.

**Specimens examined.**— Río Huichihuayán 2 km. S of Huichihuayán, Río Axtla at the ferry to Xilitla.

**Other collection records.**— Río Axtla at Axtla, Río Matlapa at Matlapa (UMMZ).

**Natural history.**— This species inhabits deeper water with more current than do the other species of the genus. The food habits are the same as those of the other swordtails. In females 19-28 mm. in standard length that I have examined the number of young was 4-11.
XIPHOEUS VARIATUS (MEEK)


**Type locality.** — Valles, San Luis Potosí, México.

**Description.** — Maximum depth of body contained 2.5-2.9 times in the standard length, length of the head 3.7-4.0 times, and the minimum depth of the caudal peduncle 5.0-5.5 times. Diameter of the eye contained 2.5-3.3 times and the minimum depth of the caudal peduncle 1.3-1.4 times in the length of the head. Dorsal fin with 10-11 rays and the anal with 7-8. Longitudinal series with 25-26 scales.

Dark olive green fading to pale olive green laterally and ventrally. Various black markings are frequently present on the dorsal and lateral surfaces. The black marking of the greatest regularity is a large lunate spot covering the base of the caudal fin.

**Range.** — Basin of the Río Soto la Marina and the lower and middle portions of the Pánuco basin.

**Distribution in San Luis Potosí.** — Found in the streams of the lowlands and foothills and in the Río Frío in the Sierra Madre Oriental.

**Specimens examined.** — Arroyo Largatija, Río Choy at Rancho Colandria.

**Other collection records.** — Ditch near Matlapa (UMMZ). Valles and Rascón (Meek 1904).

**Natural history.** — The habitat requirements and food habits of this species are the same as those of *Xiphophorus montezumae*. 

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Remarks.— Judging from the relative abundance of specimens in the collections of Tulane University from the Río Forlón, this is the most common swordtail in the northern part of the Pánuco basin, but in the part of the Pánuco basin found in San Luis Potosí it is one of the least abundant swordtails.

Family MUGILIDAE

MUGIL CUREMA CUVIER AND VALENCIENNES

*Mugil curema* Cuvier and Valenciennes, Hist. Nat. Poiss., 11, 1836: 64.

Type locality.— Brazil.

Description.— Maximum depth of body contained 4.0–4.3 times and the length of the head 3.6–4.0 times in the standard length. First dorsal with 4 spines, the last being much more slender than the others. Second dorsal with a single slender spine followed by 9 rays and covered with scales. The anal with 3 spines, the first minute, and 9 soft rays. Longitudinal series with 35–39 scales.

Pale olive brown dorsally and silvery ventrally. Iris with yellow spots, and some yellow on the operculum. A prominent black spot at the base of the pectoral fin.

Range.— Cape Verde Islands and both coasts of America from the United States to Brazil and Chile.

Distribution in San Luis Potosí.— Streams of the lowlands and foothills.

Specimens examined.— Arroyo Largatija, Valles, El Nacimiento del Coy, Puente de Dios.
Natural history.— This species inhabits streams with little to moderate current and feeds on plankton. During the day it is found near the bottom and at night it is found in schools at the surface. This is apparently due to the cyclic behavior of the plankton on which it feeds.

AGONOSTOMUS MONTICOLA (BANCRFT)


Type locality.— Jamaica.

Description.— Maximum depth of body contained 3.5-4.5 times and the length of the head 3.6-4.3 times in the standard length. Diameter of the eye contained 3.5-5.2 times in the length of the head. First dorsal fin with 4 slender spines, second dorsal with single spine and 8 soft rays, and the anal with 2 spines and 10 soft rays. Longitudinal series with 38-44 scales.

Olive brown dorsally and silvery ventrally. Scales of the dorsal and upper lateral surfaces with darker edges, which often are expanded into faint irregular spots.

Range.— Streams of the West Indies and the Atlantic and Pacific drainages of México and Central America.

Distribution in San Luis Potosí.— Restricted to streams of the foothills region.

Specimens examined.— Río Axtla 2 mi. E of Axtla, Río Claro, Río Moctezuma at Tamazunchale.
Natural history.— Essentially an inhabitant of clear cool streams with considerable current. The preferred habitat seems to be rapids with large rocks where it hides behind or under the rocks. It feeds on insects, primarily water striders, which it picks up in the rapids or in eddies above or below the rapids.

Remarks.— I have seen this species in additional localities, but it is extremely difficult to capture due to its habitat, agility, and shyness.

Family CENTROPOMIDAE

CENTROPOMUS UNDECIMALIS (BLOCH)


Type locality.— Jamaica.

Description.— The data for the single specimen on which detailed counts and measurements have been made in the laboratory is as follows: Standard length 224 mm. Maximum depth of body contained in the standard length 3.2 times and the length of the head 2.7 times. Diameter of the eye contained 5.7 times in the length of the head, the length of the snout 3.3 times, and the interorbital width 5.5 times. First dorsal fin with 8 spines, the first 2 and the last 2 being very small, and the second dorsal with 1 spine and 10 soft rays. Anal fin with 3 spines, the first very short and the second slightly longer than the third, and 6 soft rays. The lateral line with 65 scales.

Dark olive green dorsally and silvery ventrally with all the fins olive green.
Range.— Atlantic coasts from Florida to Panama, and the West Indies. Ascending rivers.

Distribution in San Luis Potosí.— Apparently limited to the rivers of the lowlands and the immediately adjacent foothills.

Specimens examined.— Río Santa María at Tamuín. Several additional specimens from the same locality that were caught by natives were examined in the field. These specimens ranged up to nearly three feet in length.

Remarks.— This species apparently occurs occasionally at Valles as the natives claim that it is caught there, but the natives in the Río Moctezuma drainage are not familiar with it.

Family SCIAENIDAE

APLODINOTUS GRUNNIENS RAFINESQUE


Type locality.— Ohio River.

Description.— The data for the single individual examined in detail is as follows: Standard length 252 mm. Maximum depth of body contained 2.8 times in the standard length and the length of the head 3.3 times. Diameter of the eye contained 5.2 times in the length of the head, the length of the snout 3.1 times, and the interorbital width 3.1 times. Dorsal fin with 10 spines and 26 soft rays and the anal with 2 spines and 7 soft rays. Lateral line with 57 scales.

Pale olive green dorsally and silvery ventrally. All fins pale olive green.
Range.— From Hudson Bay and the Great Lakes south through the Mississippi drainage and along the Gulf coast to the Río Usumacintia of Guatemala.

Distribution in San Luis Potosí.— Limited to the larger streams of the lowlands and foothills, and the Río Santa María in the Sierra Madre Oriental.

Specimens examined.— Puente de Dios. Two smaller specimens were identified in the field at Valles but subsequently disappeared from the collections.

Natural history.— The stomach contents of the single specimen examined in detail consisted of the remains of small decapod crustaceans and odonatan larvae.

Family CICHLIDAE

CICHLASOMA BARTONI (BEAN)


Type locality.— Huasteca Potosina, San Luis Potosí, México. [= Río Verde, San Luis Potosí].

Description.— Maximum depth of body contained 2.2–2.5 times in the standard length and the length of the head 2.3–2.5 times. Diameter of the eye contained 4.3–6.1 times in the length of the head and 1.3–2.5 times in the length of the snout, which in turn is contained 2.3–3.3 times in the length of the head. The least fleshy interorbital width contained 3.3–3.7 times in the length of the head. The minimum depth
of the caudal peduncle contained 1.0-1.1 times in its length. Dorsal fin with 14 or 15 spines and 10 or 11 soft rays. Anal fin with 4 or 5 spines and 7-9, usually 8, soft rays. Pectoral fin with 13-15, usually 14, rays. Pelvic fin with 1 spine and 4 or 5, usually 5, soft rays. Longitudinal series with 27-28 scales.

The coloration is quite variable, but the ground color is usually dark olive brown dorsally and paler olive brown laterally and ventrally. There are usually 4 to 6 black vertical bars laterally and a black caudal spot. These black markings are much more pronounced in young individuals and may be completely lacking in large individuals. Many individuals have the dorsal area pale gray and the entire lateral and ventral surfaces black.

Range:— Confined to the Río Verde.

Distribution in San Luis Potosí:— Limited to that portion of the Río Verde and its associated waters found in the valley in which the town of Río Verde is located.

Specimens examined:— La Media Luna, Puerta del Río, and the Río Verde at Río Verde.

Natural history:— This species seems to prefer relatively shallow water with little or no current where it is found on the bottom or along the banks. The food consists primarily of plant materials such as detritus and algae, but an occasional aquatic invertebrate or small fish is found among the contents of the digestive tract.

Remarks:— The type locality, along with the type specimens, was sent to Bean by Dr. Dugès of Guanajuato. I feel that the type locality
should be restricted to Río Verde for several reasons. The form does not occur in the area usually known as the Huasteca (the lowlands of northern Veracruz and southern Tamaulipas, and the lowlands and foothills of San Luis Potosí). Río Verde is the most likely locality for the collection of this species by Dugés as it is and was (because of the railroad) the most accessible locality within the limited area of distribution of the species.

CICHLASOMA CYANOGUTTATUM CARPinte (JORDAN AND SNYDER)

Neotroplus carpintes Jordan and Snyder, Bull. U.S. Fish. Comm., 1900: 146, fig. 22.

Type locality.— Laguna de Carpinte [= Laguna Carpintero], Tampico, Tamaulipas, México.

Description.— Maximum depth of body contained 1.8-2.3 times in the standard length and the length of the head 2.5-2.9 times. Diameter of the eye contained 3.3-5.1 times in the length of the head and 1.0-2.5 times in the length of the snout, which in turn is contained in the length of the head 2.3-3.4 times. The least fleshy interorbital width is contained 2.3-3.3 times in the length of the head. The minimum depth of the caudal peduncle is contained 0.8-1.1 times in its length, the relative depth of the peduncle being greater in large individuals. Dorsal fin with 16 spines and 9-11 soft rays. Anal fin with 5 spines and 6-9 soft rays. Pectoral fin with 13-15, usually 14, rays and the pelvic with 1 spine and 5 or 6 soft rays. Longitudinal series with 26-28 scales.
As in most of the cichlids the coloration is quite variable, but the ground color is usually dark olive brown dorsally and paler olive brown laterally and ventrally. There are usually 5 or 6 black vertical bars laterally and a black caudal spot. As in the other cichlids these are more pronounced in young individuals and may be completely lacking in large individuals. In addition to the usual black markings, some individuals have variable black markings on the ventral surface of the head and abdomen. Large males with a well-developed nuchal hump frequently have the scales with yellow centers and pale violet margins and the bases of the dorsal, anal, and caudal fins deep violet colored and spotted with blue-green.

Range.—Middle and lower portions of the Pánuco basin.

Distribution in San Luis Potosí.—Found in all the streams of the lowlands and foothills and in the Río Frío in the Sierra Madre Oriental.

Specimens examined.—El Salto, Naranjos, Valles, Laguna Ebano, Arroyo Largatija, El Nacimiento del Coy, Río Choy at Rancho Colandria, Arroyo Huichi, Río Axtla 2 mi. E of Axtla, Río Axtla at the ferry to Xilitla, Arroyo Matlapa 1 mi. N of Matlapa, Tamazunchale, Río Claro.

Other collection records.—Arroyo del Limoncito, Arroyo Plan de Jalpilla, Río Axtla at Axtla, Río Coy near Tancanhuitz (UMZ).

Natural history.—The habitat requirements do not seem very specific, but it is more abundant in clear streams. The food consists primarily of plant materials but occasional invertebrates and small fish are found in the contents of the digestive tract.
CICHLASOMA STEINDACHNERI JORDAN AND SNYDER

Cichlasoma steindachneri Jordan and Snyder, Bull U.S. Fish. Comm., 1900: 143, fig. 20.

Type locality.— Río Verde [= Río Frío] at Rascón, San Luis Potosí, México.

Description.— Maximum depth of body contained 2.1–2.6 times in the standard length and the length of the head 2.4–2.8 times. Diameter of the eye contained 3.3–5.0 times in the length of the head and 1.0–2.4 times in the length of the snout, which in turn is contained in the length of the head 2.0–3.6 times. The least fleshy interorbital width contained 2.7–4.1 times in the length of the head. The depth of the caudal peduncle contained in its length 0.9–1.2 times (this proportion seems to vary more from place to place than it does with the size of the individuals). The dorsal fin has 14–17, usually 15 or 16, spines and 10–12, usually 10 of 11, soft rays. The anal fin has 4–6, usually 5, spines and 7–10, usually 8, soft rays. Pectoral fin with 14–16, usually 15, rays and the pelvic fin with 1 spine and 3–5, usually 5, soft rays. Longitudinal series with 26–29 scales.

The coloration is generally similar to that of the other cichlids in the state, but the heads of larger individuals tend to be suffused with green. This species has individuals with abnormal melanism, which may vary from additional black on the ventral parts of the head and abdomen to cases where the individual is entirely black. Numerous individuals of the latter type are encountered in the Río Verde Valley.
Range.— With the exception of the headwaters of the Río Santa María and the Río Moctezuma, it is found throughout the Pánuco basin.

Distribution in San Luis Potosí.— Found in all waters with natural populations of fishes except the extreme upper part of the Río Santa María and its associated waters.

Specimens examined.— Puerta del Río, Río Verde, La Media Luna, Guayabos, Tanlacú, Rascón, El Salto, Naranjos, Valles, Arroyo Largatija, El Nacimiento del Coy, Río Choy at Rancho Colandria, Arroyo Huichi, Río Claro, Laguna Ebano, Tamazunchale, Arroyo Palitla, Arroyo Matlapa 1 mi. N of Matlapa, Río Axtla at Xilitla ferry, Río Axtla 2 mi. E of Axtla.

Other collection records.— Axtla, Arroyo Plan de Jalpilla, Río Coy near Tancanhuitz, Arroyo Matlapa at Comoca, Arroyo Limoncito (UMMZ).

Natural history.— The habitat requirements are not closely restricted, but it is more abundant in clear streams. The food habits vary from one locality to another with no apparent set pattern based on the part of the drainage. In some localities the diet consists of aquatic invertebrates and small fishes, while in other localities the diet consists almost entirely of small molluscs, predominantly snails.

Remarks.— I consider Cichlasoma labridens (Pellegrin) to be the same species as Cichlasoma steindachneri. The only notable differences between individuals from the two type localities (Río Verde for labridens and Rascón for steindachneri) are the shape of the pharyngeal teeth and the size of the pharyngeal arch. The larger individuals from the type locality of labridens have the enlarged middle teeth blunt and the arch very massive, while those from the type locality of steindachneri have
a small recurved tip surmounting the enlarged base of the tooth and the arch is less massive. The presence or absence of the small recurved tips on the teeth is dependent on the degree of wear in correlation with the nature of the diet. In all cases the very small individuals have the recurved tips and the arch less massive. In localities where the diet consists primarily of snails, as is true at Río Verde, there is a progressive wearing away of the tips of the teeth and an increase in the massiveness of the arch so that in individuals over five inches in total length the tips have disappeared and the arch has become very massive. In localities where the diet consists primarily of insects, crustaceans, and small fish, as is true at Rasón, the small tips and the less massive arch persist throughout the life of the individual. These phenomena and many intermediate conditions are noted at localities other than Río Verde and Rasón.

Family ELEOTRIDAE

**Gobiomorus dormitor** Lacepede


**Type locality.** — Martinique.

**Description.** — Maximum depth of body contained 5.0–6.5 times in the standard length and the length of the head 3.0–3.6 times. Diameter of the eye contained 4.4–6.7 times in the length of the head and less than the interorbital width. First dorsal fin with 6 slender spines, and the second dorsal and the anal each usually with 10, rarely 9, soft rays. Longitudinal series with 57–68 scales.
The dorsal surface has a base color of medium yellow-brown but is so heavily mottled with dark brown that it appears to be dark brown with some yellow-brown mottling. The color of the ventral surfaces and the ground color of the fins is buffy. There is an irregular dark brown lateral band, formed by coalescent spots of various sizes, extending from the base of the pectoral fin to the base of the caudal fin. The dorsal fins are marked by oblique rows of dark brown spots and the pectoral and caudal fins are marked by transverse rows of dark brown spots. The pelvic and anal fins are unmarked.

Range.—Islands of the West Indies and streams from Tamaulipas to Panama.

Distribution in San Luis Potosí.—Streams of the lowlands and foothills, and the Río Frío in the Sierra Madre Oriental.

Specimens examined.—Arroyo Huichi, Arroyo Largatija, Puente de Dios, El Nacimiento del Coy, and Valles.

Other collection records.—Tamazunchale, Río Moctezuma 4 km. S of Tamazunchale (UMMZ). Rascón (Meek 1904).

Natural history.—This bottom dwelling form feeds primarily on insects and crustaceans but occasionally takes small fish. It seems to be most active at night when it is found near the banks feeding on Macrobrachium.

Remarks.—I have seen this species in other localities but did not secure specimens because of the difficulty of catching it.

Family GOBIIDAE
AWAOUS TAIASICA (LICHTENSTEIN)

**Cobius tajasica** Lichtenstein, Berlin Abhandl., 1822: 106.

*Type locality.*—Brazil.

*Description.*—Maximum depth of body contained 5.0-6.1 times in the standard length and the length of the head 3.0-3.6 times. Diameter of the eye contained 4.5-6.3 times in the length of the head. First dorsal fin with 6 slender spines. Second dorsal fin and the anal fin each with 11 rays. Longitudinal series with 70-81 scales. The upper lip longer than the lower lip and the eyes placed dorsally, the interorbital width being less than the diameter of the eye.

Light yellow-brown dorsally and cream colored ventrally. Irregularly spotted with dark brown dorsally and laterally with the spots tending to form vertical bars and an irregular, interrupted, wide lateral band. Fins cream colored. Dark brown spots on the caudal fin forming several somewhat wavy lines in the general form of broad V's with the apexes directed posteriorly. Dark brown spots on the two dorsal fins forming several oblique rows. Pectorals marked by a single short dark brown line extending from the head onto the upper part of the basal part of the fin. Pelvic and anal fins unmarked.

*Range.*—Islands of the West Indies and the coasts and rivers of tropical America from Southern California to Panama, and from México to Brazil.

*Distribution in San Luis Potosí.*—Streams of the lowlands and foothills.
Specimens examined.— Arroyo Huichi, Valles, Puente de Dios, Tamazunchale, Río Claro.

Other collection records.— 4 km. SW of Tamazunchale (UMMZ).

Natural history.— This is a bottom dwelling form that feeds on algae, plant detritis, and microcrustaceans such as copepods and ostracods. Specimens taken in February and July show well-developed gonads. The species seems to prefer clear streams with a rocky bottom.

Remarks.— I have seen this species, which is very easily identified in the field on the basis of its general form and closely-set eyes, in many localities where I did not secure specimens. It is very difficult to collect as it tends to hide in fissures in the rocks when disturbed and also seems to be highly resistant to the shock of explosions and poisons.
INTRODUCED SPECIES AND SPECIES OF DOUBTFUL OCCURRENCE

CYPRINUS CARPIO LINNAEUS

This species has been introduced into Presa San José, a large water supply reservoir a short distance southwest of the city of San Luis Potosí, and is well established in this single locality.

CARASSIUS AURATUS (LINNAEUS)

The goldfish was introduced into Laguna de las Rusias in the early to middle 1800's at the time of its development as a resort. It now forms the largest element in the fauna of the Río Santa María as far downstream as Santa María del Río. Most of them have reverted to the olive drab wild type, but an occasional bright orange individual is still encountered.

ANGUILLA ROSTRATA (LE SUEUR)

There are apparently no specimens of the species from San Luis Potosí in scientific collections, but the state lies within its known range. The natives in the lowlands and foothills are familiar with the eel and say that it is occasionally taken at many localities. Manuel Rivera, my field associate, says that he has caught eels at Tamazunchale.
MICROPTERUS SALMOIDES (LACEPEDE)

This species was introduced in 1950 into Presa Gonzalo Santos, a city water supply lake southwest of the city of San Luis Potosi, with stock imported from northern Queretaro. Apparently it is now fairly well established in this single locality within the state.

LEPOMIS MACROCHIRUS RAFINESQUE

This species was likewise introduced into Presa Gonzalo Santos in 1950 with stock imported from Queretaro. It is much more abundant than is Micropterus salmoides.

POMADASYSIS BOUCARDI (STEINDACHNER)

This species was recorded from San Luis Potosi when Meek (1904) reported it from Valles as Pomadasysis templei, a new species. Pomadasysis templei was considered by Regan (1908) to represent merely young individuals of Pomadasysis boucardi.
The ichthyofauna of the Río Pánuco drainage of San Luis Potosí is rather limited, consisting of representatives of 18 families, 33 genera, 48 species, and 51 forms including subspecies. Of these, one family, four genera, and four species are represented only by introduced forms.

When one considers the indigenous fauna from the standpoint of the principal distribution of the families within the western hemisphere, it may be divided into four groups. Three of these are of approximately equal size. The fourth is a minor group only one-third the size of the other groups. Fishes with North American affinities include 14 forms; those with Central and South American affinities, 16 forms; those with marine affinities, 12 forms; and those with purely Mexican affinities, five forms.

In spite of its general affinities with the ichthyofauna of other areas, that of the Río Pánuco shows a high degree of endemism. Within San Luis Potosí are found 18 genera, 32 species, and 35 forms which may be considered members of essentially fresh-water families. Of these, three genera, 16 species, and 21 forms are found only in the Pánuco drainage; 12 genera, 13 species, and 11 subspecies are found in other Atlantic drainages; and six genera, three species, and two subspecies are found also in the Lerma-Santiago system of the Pacific drainage. Of the last group, all of the species and three of the genera are endemic to the Lerma-Santiago and upper Pánuco drainages, while the other three genera are of widespread distribution. It is
noteworthy that of the three genera, 16 species, and 21 forms endemic to the Pánuco drainage, two genera, 11 species, and 15 forms are known only from that portion of the Pánuco drainage found in San Luis Potosí. The 11 genera and 12 species which may be considered members of essentially marine families, with the exception of a single endemic cyprinodontid of an undescribed genus and species, are found in other Atlantic drainages. A few of these species are found in some Pacific drainages.

For consideration of the relative time of invasion of San Luis Potosí by the major groups, as indicated by distribution and endemism, it seems desirable to discuss the plateau and the rest of the state separately. The plateau is clearly an area initially inhabited by a fauna derived from North American ancestral forms and an ancestral form, either marine or North American, which gave rise to the goodeids. This initial invasion appears to have taken place at a time when the plateau part of San Luis Potosí was drained by streams emptying into the Pacific. This invasion was followed by a later invasion by Central American forms, which, with the exception of Astyanax fasciatus mexicanus, have penetrated only the extreme eastern part of the area. This later invasion followed the shifting of the plateau portion of the state to the Atlantic drainage. The rest of the state has been subjected to repeated invasions by both North and Central American forms. These have given rise to a mixed fauna of North and Central American forms with both groups represented by nonendemic species, endemic subspecies, and endemic species. A later invasion by marine forms added a large nonendemic element to the fauna of the eastern part of the area.
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*x* indicates indigenous

*i* indicates introduced
DISTRIBUTIONAL AREAS OF THE PÁNOCO BASIN

Meek (1904) and de Buen (1946) considered the Río Pánoco as the zone of transition between the Neotropical and Nearctic Realms and divided it into three sections. These were the Tampico Section, consisting of that portion of the drainage on the coastal plains; the Valles Section, consisting of the portion within the foothills and mountains, the middle part of the Río Santa María, and the entire Río Verde; and the Moctezuma Section, consisting of the headwaters of the Río Moctezuma and Río Santa María. The contention by Meek and de Buen that the Pánoco represents a zone of transition appears to me to be valid, but the division into three sections seems an oversimplification of a much more complex situation—a division which takes into account only the greatest magnitude of faunistic change.

On the basis of differences in the species present and the percentages of population composition, it seems more appropriate to divide the Pánoco system into at least seven major sections with further division of at least one of these into subsections. Of the major sections, the Tampico Section, the Tamesí Section, and the Moctezuma Section lie wholly outside the boundaries of San Luis Potosí and are, therefore, outside the scope of the present study. The Tampico Section, consisting of the lower Pánoco and lower Tamesí, is characterized by considerable intrusion of marine and brackish water forms. The Tamesí Section, a recent addition to the Pánoco system as a result of emergence of the coastal area, shows some difference in species present and considerable difference in population composition when compared to similar parts of
the remainder of the Pánuco drainage. The Moctezuma Section, consisting of the Río San Juan and the Río Tula, is a portion of Pacific drainage added to the Pánuco system by stream capture and shows strong affinities with the area of Pacific drainage adjacent to it.

Largest of the sections in San Luis Potosí is the Huasteca Section, which may be divided into the subsections Tamuín, Valles, Rascón, and Tamazunchale. The Tamuín Subsection, consisting of the coastal plain portions of the Río Santa María and Río Moctezuma and the entire Río Choy, is distinctive in the following ways; typically marine forms are fairly well represented with *Centropomus undecimalis* common and *Dorosoma cepedianum* and *Dorosoma petenense* abundant; the dominant forms of poeciliids are the various species of *Gambusia,* and some forms characteristic of cooler, swifter, waters such as *Agonostomus monticola* are absent. The Valles Subsection, consisting of the Río Coy, the lower part of the Río Valles, and the associated part of the Río Santa María, and the Tamazunchale Subsection, consisting of the middle portion of the Río Moctezuma and its tributaries, are distinguished from the Tamuín Subsection by a lessening of the importance of marine and brackish water elements, by having the species of mollies and swordtails as the dominant poeciliids, and by the presence of forms typical of cooler, swifter waters. The faunas of the Valles and Tamazunchale Subsections are very similar, but there are some species not common to both such as *Xiphophorus pygmaeus* and *Gambusia axtla* of the Tamazunchale Subsection and *Xiphophorus milleri* of the Valles Subsection. In the Tamazunchale Subsection the species of *Xiphophorus* and *Pseudoxiphophorus* are more
prevalent than *Mollieinaeia sphenops*, and the dominant cichlid is *Cichlasoma steindachneri*. In the Valles Subsection *Mollieinaeia sphenops* is more prevalent than the combined species of *Pseudoxiphophorus* and *Xiphophorus* and the dominant cichlid is *Cichlasoma cyanoguttatum*. The Rascón Subsection, consisting of the Río Frío and the Río Valles above San Mateo, is characterized by a sharp reduction in the number of species present, as later additions to the Pánuco fauna such as the marine element have not been able to enter the area because of the physical barriers in the form of falls. Several species rarely encountered in the other parts of the Huasteca Section, for example *Ictalurus mexicanus*, are abundant in this subsection.

The middle part of the Río Santa María and the middle and lower portions of the Río Verde (below its exit from the Río Verde Valley) form the Tanlactá Section. This section is very poor in numbers of species. It lacks the poeciliids, mugilids, and clupeids characteristic of the Huasteca Section, and the goodeids and cyprinids of the plateau. The common species in this area are *Ictiobus labiosus*, *Diophdas rasconis rioverdenis*, *Ictalurus punctatus*, *Astyanax fasciatus mexicanus*, and *Cichlasoma steindachneri*.

The Río Verde Valley, a Pleistocene lake bed, and its associated drainage form the Río Verde Section. This section is allied with the Tanlactá Section, but its fauna lacks *Ictiobus labiosus* and *Ictalurus punctatus*. The latter is replaced by *Ictalurus mexicanus*. In addition, it contains forms not found in the Tanlactá fauna such as *Ataeniobius toweri*, *Cichlasoma bartoni*, and an endemic species of cyprinodontid.
The first indicates a rather remote affinity with the Santa Marfa Section and the Lerma-Santiago drainage.

The Santa Marfa Section, formed by the headwaters of the Río Santa Marfa and a few isolated drainages within the San Luis Potosí Valley, is the exceptional area within the state. It has only one species (*Astyanax fasciatus mexicanus*) in common with the other sections of the Pánuco drainage in the state, and the affinities of its other species are entirely with the ichthyofauna of the upper Lerma-Santiago drainage of the area to the south and west. Its indigenous fauna consists of one characin (*Astyanax fasciatus mexicanus*), two species of cyprinids (*Algansea affinis* and *Notropis calientis potosensis*), and four forms of goodeids (*Xenotoca variata*, *Goodea gracilis*, *Xenoophorus captivus captivus*, and *Xenoophorus captivus exsul*). In addition, limited parts of the section are inhabited by four introduced forms (*Cyprinus carpio*, *Carassius auratus*, *Micropterus salmoides*, and *Lepomis macrochirus*). Of the indigenous forms found in this section, the two forms of *Xenoophorus* are endemic to the Santa Marfa Section; *Xenotoca variata* is widespread in the Lerma-Santiago drainage; *Notropis calientis potosensis* is represented in the Lerma-Santiago basin by its nominate subspecies; *Algansea affinis* is found in the upper Río Lerma and the Río San Juan (an upper tributary of the Río Moctezuma); *Goodea gracilis* is found in the Río San Juan; and *Astyanax fasciatus mexicanus* is widespread in Atlantic and Pacific drainages. On the basis of the common possession of *Goodea gracilis*, the sections here referred to as the Moctezuma Section and the Santa Marfa Section were considered a single
distributional area (Moctezuma Section) by Meek (1904). However, this lumping of the two sections seems highly inappropriate as they have only two forms (Goodea gracilis and Algiennea affinis) in common, while the Santa Marfa Section has four forms not occurring in the Moctezuma Section and the Moctezuma Section has five forms not occurring in the Santa Marfa Section.
FACTORS INFLUENCING DISTRIBUTION

Chemical factors seem to be of minimal importance in the distribution of the fishes of San Luis Potosí. While at any one time there may be relatively great chemical differences between various parts of the drainage, any one part of the drainage may pass through the complete range of variation either seasonally or daily, thus tending to obliterate any influence chemical factors may have on distribution. However, this variation alone would tend to limit the fauna to species able to cope with large and rapid changes in chemical conditions. Only in the case of the separation of the Río Verde Section from the Tanlacuí Section does the chemical factor seem to play an important part. In this case, the constancy of chemical conditions in the Río Verde Section as compared to the fluctuation in the Tanlacuí Section may be the factor controlling the distribution of the species endemic to the Río Verde Section. However, constancy of physical conditions may play an equal or more important part in this distribution.

Of greater importance than chemical factors, are physical factors such as temperature, turbidity, current, and stream size. These factors are more important in influencing distribution from one part of a stream to another part rather than from one stream to another. Among the species whose distribution within a stream are controlled by physical factors are Agonostomus monticola, found only in rapids, and most of the species of Xiphophorus, found only in quiet, nearly currentless, waters. The physical conditions of warm, turbid, trunk streams and clear, cool,
tributaries found in the Pánuco basin are conducive to a high degree of speciation because of the barriers thus formed. On the other hand, the highly seasonal nature of the rainfall largely negates these barriers. It lowers the turbidity of the trunk streams and increases the temperature of the tributaries during the dry season. It decreases the temperature of the trunk streams and increases the turbidity of the tributaries during the rainy season. Physical factors apparently are important in separation of the Tanlacú Section from the Río Verde and Santa María Sections. The small size of the streams in the two latter sections seems to prevent the entry of forms typical of the larger rivers, such as *Ictiobus labiosus* and *Aplodinotus grunniens*. The forms endemic to the Río Verde Section, such as *Ataeniobius toweri* and the undescribed cyprinodontid, seem to require conditions of physical stability and minimal current and may be barred from the Tanlacú Section by increased current and variation of physical conditions. Eastward movement of the fauna of the Santa María Section may be prevented by the increased gradient of the Río Santa María east of this area, as the fishes of this area inhabit ponds and quiet pools of streams and are rarely, if ever, encountered in water with moderate to strong current.

Biotic factors seem to be responsible for the separation of the Tanlacú Section from the Huasteca Section. The absence of aquatic vegetation and the small aquatic animals associated with it is probably responsible for the lack of poeciliids in the Tanlacú Section.
The dominant factors influencing the distribution of fishes within San Luis Potosí are the post-Cretaceous geology of the area and the time of invasion by the various species. For further discussion of this phase, the plateau and the regions east of the plateau will be considered separately.

The major portion of the plateau in the state is an area of basin drainage devoid of fishes as a result either of a lack of connections with nonbasin drainage systems at any time fishes were available for invasion or elimination of earlier fauna by the highly saline and alkaline conditions and the intermittent nature of the waters. The rest of the plateau (the Río Verde Section and the Santa Marfa Section) is quite definitely a former portion of the upper Lerma-Santiago system of the Pacific drainage that has been diverted to the Atlantic drainage. This has been accomplished by headward erosion of the Río Santa Marfa system, by crustal uplift and folding, and by large scale extrusion of igneous materials.

The separation of the Río Verde Section from the Santa Marfa Section and from the Pacific drainage is the result of crustal uplift and folding and probably predated the separation of the Santa Marfa Section from the Pacific drainage. This interpretation is supported by the following evidence: the Río Verde Valley is separated from the San Luis Potosí Valley by a chain of mountains formed by the dissection of a single large anticline, trending from northwest to southeast, and is the dry bed of a Pleistocene lake apparently formed by blocking of the earlier drainage to the west by this folding and uplift; the forms
having affinities with those of the Pacific drainage are limited to *Ataeniobius toweri*, the most primitive of the goodeids, and possibly the single endemic cyprinodontid; and the fauna shows a much stronger affinity with that of the Atlantic drainage than does the fauna of the Santa Marfa Section.

The separation of the Santa Marfa Section from the Pacific drainage seems to have been due to igneous activity with large scale flow of materials from fissures, often forming deposits of rhyolite of a thickness of 2000 feet or more in the areas south and west of the Santa Marfa Section. These extrusions blocked the then existing drainage of the area and caused the formation of a large lake, now represented by the broad flat valley in which lies the city of San Luis Potosí. This disturbance is apparently more recent than the one mentioned in connection with the Río Verde Section. These conclusions are indicated by the much closer affinity of the fauna with that of the upper Lerma-Santiago system and the almost complete lack of forms from the Atlantic drainage.

The area east of the plateau, that is, the mountainous and coastal plain portions of the state, do not lend themselves as well to an analysis of faunal distribution from the viewpoint of geological history and time of invasion by species as does the plateau. However, on the basis of distribution, it seems that the ichthyofauna of this area can be divided into two groups: (1) those species that invaded the area before the disturbance that formed the eastern portion of the Sierra Madre Oriental and its foothills; (2) those species that invaded
the area after this disturbance. The first group consists of such forms as most of the poeciliids, cichlids, and cyprinids, while the second group consists of those species with marine affinities and many of the species with North American affinities.

The effect of geological factors is noted in the formation of the Rascón Subsection, for the erection of physical barriers in the nature of falls has prevented the invasion of this subsection by the members of the second group, thus limiting its fauna to members of the first group. This subsection now consists of two isolated segments, but it seems that in the past the Río Frío may have been a tributary of the Río Valles and that crustal folding and uplift have interrupted this connection. The differences between the faunas of the Río Frío and the Tanlacú Section, with which it connects, may be attributed to more than one factor. Changes in the ecological conditions may have eliminated the typical Río Frío forms within the Tanlacú Section and physical barriers may have prevented invasion of the Río Frío by more recent elements of the Tanlacú fauna. However, in view of the great similarity of the faunas of the Río Frío and the upper Río Valles and their differences from the fauna of the Tanlacú Section and the fauna of the lower Río Valles, it seems more likely that the Río Frío received its fauna from the Río Valles and that the same disturbance caused an interruption of the connection between these rivers and the isolation of the upper part of the Río Valles from the lower part.

The influence of man on the distribution of fishes in San Luis Potosí is of minor importance. Probably his greatest influence has
been on the percentage composition of populations in limited areas, particularly in the vicinity of towns, where dumping of raw wastes has led to large populations of scavenger species. In addition to his effect on population composition, man has had a limited influence on the distribution within the plateau area. Extensive withdrawal of water for irrigation, particularly during the dry season when the amount of water in impoundments and streams is at a minimum, has resulted in some reduction in the amount of habitat available to fish. Four exotic species, *Cyprinus carpio*, *Carassius auratus*, *Micropterus salmoides* and *Lepomis macrochirus*, have been introduced into limited areas on the plateau. Of these, only *Carassius auratus* has become established in natural bodies of water with indigenous ichthyofauna.
The ichthyofauna of San Luis Potosí contains representatives of seven orders, 18 families, 33 genera, 48 species, and 51 forms, with 14 forms showing North American affinities, 16 forms Central and South American affinities, 12 forms marine affinities, and five forms purely Mexican affinities. One family, four genera, four species, and four forms are represented only by introduced members. Of the indigenous ichthyofauna, four genera, 17 species, and 22 forms are endemic to the Pánuco basin, while three genera, 12 species, and 16 forms of this endemic group are restricted to the part of the basin lying in San Luis Potosí. The descriptions of two new species and three new subspecies are included in the report. A form of a previously unknown genus and species discovered during the course of the investigations is being described by Dr. Robert R. Miller of the University of Michigan Museum of Zoology.

Based on the distribution and relative abundance of the various forms, the Pánuco basin is divided into seven sections. Three of these sections, the Tampico Section, the Tamesí, and the Moctezuma Section, lie wholly outside the boundaries of San Luis Potosí. The sections found within the boundaries of San Luis Potosí are the Huasteca Section, the Tanlacrú Section, the Río Verde Section, and the Santa María Section. The Huasteca Section is divided into four subsections, the Tamuín Subsection, the Valles Subsection, the Rascón Subsection, and the Tamazunchale Subsection.

The distribution of the various forms, as related to the sections
in which they are found, seems to be determined primarily by the post-Cretaceous geology of the area and the time of invasion of the various species. However, in the case of the Tanlacú Section, physical and biotic factors seem to effect its separation from the contiguous areas. Local distribution from one part to another within individual streams seems to be controlled by physical and biotic factors.
GAZETTEER

In the following list of the localities from which fish have been recorded, place names are followed by co-ordinates to the nearest minutes of, first, north latitude, and, second, west longitude. The co-ordinates are followed by location numbers, which provide a key to the positions of the localities on the accompanying map.

Agua del Medio.— 22°50', 101°06'; loc. 2. A small spring-fed drainage between Moctezuma and Venado.


Arroyo Grande.— 22°03', 99°04'; loc. 20. A tributary of the Río Valles approximately 5 mi. NW of Valles.

Arroyo Huichi.— 21°58', 98°44'; loc. 32. A small tributary of the Río Santa María approximately 2 mi. E of Tamuín.

Arroyo Largatija.— 21°57', 99°01'; loc. 33. A small tributary of the Río Valles approximately 2 mi. S of Valles.

Arroyo del Limoncito.— 22°09', 99°01'; loc. 18. A small tributary of the Río Valles approximately 10 mi. N of Valles.

Arroyo Palitla.— 21°20', 98°47'; loc. 46. A tributary of the Río Moctezuma crossed by the Pan-American highway at the village of Palitla approximately 5 mi. N of Tamazunchale.

Arroyo Santa Isabel del Coy.— 21°37', 98°57'; loc. 37. A tributary of the Río Coy.

Axtla.— 21°27', 98°52'; loc. 43. A village on the Río Axtla.

Bledos.— 21°51', 101°07'; loc. 7. A village with a number of spring-fed ponds.

Cueva Chica.— 21°50', 98°59'; loc. 34. Cave near Pujal with an underground stream.

Cueva de los Sabinos.— 22°04', 98°57'; loc. 30. Cave with an underground stream approximately 7 mi. NE of Valles.
El Nacimiento del Coy.— 21°41', 98°58'; loc. 36. A large spring at the headwaters of the Río Coy.

El Salto.— 22°35', 99°23'; loc. 16. A large falls on the upper Río Valles.

Guayabos.— 21°41', 99°30'; loc. 27. A village on the Río Verde.

Huichihuyáñ.— 21°30', 98°57'; loc. 42. A village on the Pan-American highway and a tributary of the Río Axtla.

Jesús María.— 21°55', 100°05'; loc. 10. A village in the southern part of the San Luis Potosí Valley.

Labor del Río.— 21°46', 100°38'; loc. 14. A village on the Río Santa María SE of Santa Marfa del Río.

Laguna Ebano.— 22°10', 98°23'; loc. 29. A lake on the coastal plain approximately 5 mi. S of Ebano.

Laguna de las Rusias.— 21°45', 100°56'; loc. 15. A large impoundment in the southern part of the San Luis Potosí Valley.

La Media Luna.— 21°52', 100°02'; loc. 11. A large spring in the southern part of the Río Verde Valley.

Matlapa.— 21°22', 98°48'; loc. 44. A village on the Pan-American highway and a tributary of the Río Axtla.

Mesqultic.— 22°16', 101°07'; loc. 4. A village in the mountains NW of the city of San Luis Potosí.

Micos.— 22°08', 99°09'; loc. 19. A village on the Río Valles and the Tampico-San Luis Potosí railroad.

Moctezuma.— 22°45', 101°05'; loc. 3. A city in the northern part of the San Luis Potosí Valley.


Presa Gonzalo Santos.— 22°03', 101°09'; loc. 6. A large water supply lake SW of the city of San Luis Potosí.

Presa San José.— 22°06', 101°04'; loc. 5. A large water supply lake SW of the city of San Luis Potosí.

Puente de Dios.— 21°48', 99°08'; loc. 25. A natural bridge across the Río Santa María within the Sierra Madre Oriental.
Puerta del Río.— 22°17', 100°15'; loc. 8. A large spring at the headwaters of the Río Verde.

Rancho Colandria.— 21°58', 98°47'; loc. 31. A ranch on the Río Choy approximately 2 mi. W of Tamuín.


Río Verde.— 21°56', 100°0'; loc. 23. A city on the Río Verde.


Río Axtla.— 21°31', 98°49'; loc. 41. A locality on the Río Axtla 2 mi. E of the village of Axtla.


Río Axtla.— 21°28', 98°53'; loc. 44. At the ferry crossing of the road to Xilitla.

Río Claro.— 21°13', 98°45'; loc. 49. A small tributary of the Río Amajaqui approximately 5 mi. S of Tamaulipas.

Río Coy.— 21°44', 98°59'; loc. 35. Point on the Río Coy where it is crossed by the Pan-American highway.

Río Coy.— 21°34', 98°55'; loc. 38. Locality on the Río Coy near Ciudad Santos (formerly Tancanhuitz).

Río Moctezuma.— 21°16', 98°49'; loc. 48. Locality on the Río Moctezuma 2 mi. SW of Tamaulipas.

Santa Catarina.— 22°03', 100°41'; loc. 13. Village on an intermittent tributary of the Río Verde in the mountains W of the Río Verde valley.

Santa María del Río.— 21°48', 100°41'; loc. 13. Town on the Río Santa María in the mountainous area S of the San Luis Potosí Valley.

Tamaulipas.— 21°16', 98°47'; loc. 47. A town on the Pan-American highway at the junction of the Río Moctezuma and the Río Amajaqui.

Tanlacin.— 21°39', 99°18'; loc. 28. A village on the Río Verde near its junction with the Río Santa María.

Venado.— 22°56', 101°06'; loc. 1. A city with a small spring-fed drainage system located in the northern part of the San Luis Potosí Valley.

Villa de Reyes.— 21°48', 100°56'; loc. 12. A town in the southern part of the San Luis Potosí Valley.
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BIOGRAPHY

Richard T. Gregg was born July 21, 1924, at Little Rock, Arkansas. He attended the public schools of Fort Smith, Arkansas, graduating from high school in May, 1942. In June, 1942, he enrolled at Texas A&M, where he remained until called to active duty in the military service. The period from February, 1943, to October, 1945, was spent in the United States Army Air Corps. Upon being discharged from military service, Mr. Gregg entered the University of Michigan and received the degree of Bachelor of Science from that institution in June, 1947.

Following graduation from the University of Michigan, he was employed by the United States National Park Service for a period of one year as a Summer Ranger-Naturalist and a Park Ranger at Yellowstone and Shenandoah National Parks.

Mr. Gregg entered the Graduate School at the University of Missouri in June, 1948, and was there until May, 1950. However, he was not a candidate for degree. He was enrolled in the Graduate School of Louisiana State University, where he was employed as a graduate assistant in the Department of Zoology, from June, 1950, through August, 1954. Since September, 1954, Mr. Gregg has been employed as a research associate by the Louisiana State University Coastal Studies Institute.
Candidate:    Richard T. Gregg

Major Field:  Zoology

Title of Thesis: A Distributional Survey of the Fishes of San Luis Potosí, México

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

July 20, 1956