

HISTORICAL COMPOSITION AND LONG-TERM TRENDS OF FISH
ASSEMBLAGES IN TWO TEXAS RIVERS AND MICROHABITAT
ASSOCIATIONS AND MOVEMENT OF GUADALUPE BASS *MICROPTERUS*
TRECVLII IN THE PEDERNALES AND SOUTH LLANO RIVERS

THESIS

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By

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CHAPTER I

HISTORICAL COMPOSITION AND LONG-TERM TRENDS OF FISH ASSEMBLAGES IN TWO TEXAS RIVERS

INTRODUCTION

A suite of biotic and abiotic structuring mechanisms influence the natural occurrence and abundance of warm-water stream fishes through time and space (Matthews 1998). However, anthropogenic alterations of riverine environments disrupt structuring mechanisms, causing minor and major changes to stream fish assemblages (Winston et al. 1991; Aadland 1993; Davis 1997; Keenlyne 1997; Luttrell et al. 1999; Haro et al. 2000; Garrett et al. 2002; Edwards et al. 2004; Rinne et al. 2005b; Adams et al. 2006; Poff et al. 2007; Runyan 2007). Major changes to stream fish assemblages include the extinction or imperilment of endemic freshwater fishes. Percent of extinct or imperiled native freshwater fishes is 21% in North America (Leidy and Moyle 1998), 28% in southeastern USA (Warren et al. 2000), and 48% in southwestern USA (Warren and Burr 1994). In Texas, 44% of native freshwater fishes are considered imperiled (Hubbs et al. 2008). Despite the alarming rate of species imperilment and the subsequent increasing trend of fish homogenization (Rahel 2000), successful protection of warm-water stream fishes can be enhanced with water quality and quantity management (Angermeier 1995; Pister 1999; Richter et al. 2003; Petts et al. 2006).

Water quantity management in Southwestern United States streams is necessary due to increasing aridity (Martin and Menringer 1965) and demand for water (McCarl et al. 1999). Low-head dams and deep storage reservoirs are common practices for securing adequate year-round water supply and hydroelectric power for urbanized or industrialized areas (Baxter 1977). Detrimental effects of reservoirs on aquatic biota are well documented (Richter et al. 1997); among others, a notable effect of reservoir construction is alteration of natural flow regime (Poff et al. 1997). Reservoirs can cause drastic reduction or elimination of small and large floods (Runyan 2007) and therefore alter numerous biotic (e.g., spawning cues; Bonner and Wilde 2000) and abiotic (e.g., stream morphology; Poff et al. 1997) factors for considerable distances downstream (Edwards 1978). Furthermore, detrimental effects continue upstream of impoundments by inundation of habitat, conversion of lotic to lentic water (Edwards 1978) and disruption of migration patterns (Bonner and Wilde 2000).

A growing body of literature exists for historical changes in stream fish assemblages in relation to anthropogenic stream alteration (see Rinne et al. 2005a). However, additional research is necessary since streams are among the most negatively impacted environments by human activity (Helfman 2007) and stream fish assemblage changes have been poorly documented with regard to the degree of existing alteration (Quinn and Kwak 2003). Analysis of long-term trends in stream-dwelling fish assemblages provides several benefits including better understanding of the extent and magnitude of anthropogenic alteration (Calamusso et al. 2005), identifying species decline prior to imperilment (Runyan 2007), consideration of changes over broad time scales (e.g., > 60 years; Gido et al. 2002) and quantifying species loss due to extirpation

or extinction (Mercado-Silva et al. 2006). Quantifying stream fish assemblage changes following stream alteration is limited by availability of baseline data collected prior to alteration (Gido et al. 2002), a limitation that has enhanced the value of historical museum collections (Suarez and Tsutsui 2004).

Purpose of this study was to assess the effects of a deep storage, hydroelectric reservoir as well as tributary impoundments and watershed flood retarding and retention dams on fish assemblages of the Guadalupe River basin, Texas. More specifically, I sought to assess changes in mean annual flow, frequency of flood events, fish assemblage structure, abundance of specific taxa, and reproductive and trophic guild abundances following anthropogenic alteration of flow regimes within a semi-arid watershed.

STUDY AREA

The Guadalupe River originates at the confluence of the North Fork Guadalupe River and South Fork Guadalupe River near the City of Hunt, Kerr County, Texas (Figure 1). The total drainage area is 15,700 km² as it flows about 370 km southeast toward the Gulf of Mexico. Among the seven mainstem impoundments on the Guadalupe River, Canyon Lake Reservoir was constructed in 1964. With a maximum depth of about 40 m and with a surface area of 3,300 ha, Canyon Lake Reservoir is the only deep storage reservoir within the Guadalupe River basin, representing the most significant alteration of mainstem discharge (Young et al. 1972; Edwards 1978). Remaining mainstem reservoirs are impounded by low-head dams (maximum height: 12 m), constructing from 1928 through 1931 in the lower Guadalupe River (Young et al. 1972).

The San Marcos River, among the largest tributaries of the Guadalupe River, originates from artesian springs in the City of San Marcos, Hays County, Texas and flows about 120 km before reaching its confluence with the Guadalupe River near Gonzales, Gonzales County, Texas. San Marcos River has seven low-head dams (maximum height: 6 m) and numerous low water crossings constructed between 1849 and 1901 (Taylor 1904). Several low-head dams were constructed in the upper Blanco River, a tributary of the San Marcos River, by Civilian Conservation Corps in mid 1930s and by private landowners through the 1950s (pers. comm. H. Hammond, Blanco County landowner). Flood retarding structures were constructed by the Natural Resource Conservation Service (NRCS) in the Plum Creek and York Creek drainages of the lower San Marcos River in the mid 1960s and 1970s (pers. comm. I. Morales, District Conservationist, NRCS, Lockhart, Texas). Flood retention structures were constructed by NRCS in the upper San Marcos River watershed in the 1980s (Woods and Earl 2002).

METHODS

Daily discharges were obtained from three locations on the Guadalupe River (US Geological Survey Station 08168500, New Braunfels, Texas; USGS Station 08176500, Victoria, Texas; USGS Station 08167500, Spring Branch, Texas) and one location on the San Marcos River (USGS Station 08172000, Luling, Texas; Figure 1). These locations encompass the largest available spatiotemporal range in drainage discharge (350 km mainstem Guadalupe River; 1927 - 2007 for Station 08168500; 1934 - 2007 for Station 08176500; 1922 - 2007 for Station 08167500, and 1938 - 2007 for Station 08172000). For each Guadalupe mainstem site, discharge data were divided into Period I (earliest

record – 1963) and Period II (1965 – 2007), using the completion of Canyon Reservoir (1964) as the environmental impact. For the San Marcos River, a break in ichthyological data ranging 1963 to 1976 was used to define Period I (1927-1963) and Period II (1976-2006), which generally corresponds with pre- and post construction of water retarding and retention dams developed in the upper and lower watershed from late 1950s through early 1980s. Changes in frequency of small and large floods and mean annual discharge between periods were assessed with Indicators of Hydrologic Alteration, v. 7.0.3 (IHA). Flood frequency and mean annual discharge were used because of strong interrelationship among these parameters, fish habitat availability, and stream morphology (Richter et al. 1996; Runyan 2007). Small floods were defined as high flow events (i.e., exceeding 75% of discharge in Period I) with recurrences of at least 2 years. Large floods were defined as high flow events with recurrences of at least 10 years.

Historical ichthyofaunal collections from the Guadalupe River and San Marcos River drainages were obtained from museum collections, agency reports, unpublished records, and published documents. Museum collections were obtained from the Texas Natural History Museum (TNHC; University of Texas), Texas Cooperative Wildlife Collection (TCWC; Texas A&M University), Tulane Museum of Natural History (Tulane), University of Kansas Natural History Museum (KU), University of Michigan Museum of Zoology (UMMZ), Field Museum of Natural History (FMNH; Chicago, Illinois), San Noble Oklahoma Museum of Natural History (OMNH; University of Oklahoma), and the National Museum of Natural History (NMNH; Smithsonian). Agency reports and published data included Texas Game and Fish Commission (TGFC, now Texas Parks and Wildlife, 1956), TGFC (1958), TGFC (1962), TGCF (1973), U.S.

Fish and Wildlife Service (1976), Underwood and Dronen (1984), Longley et al. (1996), Terre and Magnilia (1996), Kelsey (1997) and Longley et al. (1998). Unpublished data were obtained from K. Mayes (Texas Parks and Wildlife Department), B. Beard (Texas Parks and Wildlife Department), B. Moring (US Geological Survey) and B. Whiteside, T. Bonner and P. Bean (Texas State University-San Marcos). Species occurrences and abundances, date and location of collection, principal collector, and methods of collection were obtained from all collections (Appendix I, II, and III).

Historical ichthyofaunal collections were filtered before assessing assemblage occurrence and abundance analyses (Runyan 2007). Species list was compared to expected ichthyofaunal list for the Guadalupe River drainage (Conner and Suttkus 1986; Thomas et al. 2007; Hubbs et al. 2008). Questionable identifications were confirmed or refuted with voucher specimens. Others were noted and removed when voucher specimens were not taken or available. Tributaries lacking sufficient temporal collections to infer assemblage changes were removed from abundance analyses. Consequently, abundance analyses were performed with assemblage data only from mainstem Guadalupe River and San Marcos River. Upper and lower Guadalupe River sections were analyzed independently because of the potential for longitudinal differences in fish assemblages. Seining and electrofishing collections within each river were retained if the collection had >5% of the total taxa found in the drainage and if the collection had >0.1% of the total number of individuals collected to improve the likelihood of the collection being a representative sample of the fish assemblage on a given date.

Fish relative abundance was calculated for each collection retained for analyses. Among collections, relative abundances of a species were $\log_{10}(N+1)$ -transformed and

plotted through time. Time represented the number of days from the first collection (June 23, 1938). Simple linear regression was used to test if slope of relative abundance differed ($\alpha = 0.05$) through time. Populations were classified as increasing ($b_I > 0$) or decreasing ($b_I < 0$) in abundance. Populations were classified as stable if slope did not differ from zero ($b_I = 0$). Population status of rare species (i.e., occurring in <10% of total collections) and populations of species reported only once were classified as indeterminable. Native status of each species was determined using Conner and Suttkus (1986), Thomas et al. (2007) and Hubbs et al. (2008). Primary and secondary reproductive guilds were determined for each species using the classification scheme of Simon (1999), and trophic guilds after Goldstein and Simon (1999). Mean relative abundance of each species, excluding rare species, for Period I and Period II was determined (sum of relative abundance in each collection/number of collections) to facilitate direct comparison of species abundance between periods. Functional changes within the assemblage were addressed using the relative abundance of each reproductive and trophic guild for each period (sum of individuals in each guild for given period/total individuals in given period).

For each period, taxa richness (S) and Simpson's Index of Diversity ($1 - D$) were calculated along with similarity matrices. Bray-Curtis similarity matrices (Bray and Curtis 1957) created in Primer 6.1.6 were tested with analysis of similarity (ANOSIM; $\alpha = 0.05$; 9,999 permutations) using permutations to assess average rank dissimilarity between periods (Runyan 2007). Data were fourth-root transformed to standardize the contribution of high and low abundance species and illustrated using a multi-dimensional scaling (MDS) plot. Mean relative abundance of MDS axis I and II were averaged for 5-

year intervals to assess trajectory of fish assemblage change. To compare collective trends in increasing or decreasing species through time, relative abundances of increasing and decreasing populations were z-scored transformed to standardized relative abundance distributions (mean = 0; SD = 1) of each species. Z-scored transformed abundances were averaged across all increasing or decreasing species by year (dependent variable) and regressed against time (independent variable) with piecewise regression model. Least-squares regression and joinpoint analyses to detect significant changes in rate through time (i.e., test for appropriate piecewise models) were performed with the program JOINPOINT (Joinpoint Regression Program, Version 3.0, National Cancer Institute, 2005), a program designed to use grid-search methods for optimizing model parameters (Brendon and Bence 2008). Parsimonious joinpoint models were selected following permutation testing ($N = 5,000$; default) rather than BIC selection approach (Brendon and Bence 2008).

RESULTS

Mean annual flows increased between periods in the Guadalupe River and San Marcos River with frequency of small and large flood events increasing only in the upper Guadalupe River and decreasing in the lower Guadalupe River and San Marcos River. Mean annual flow in the upper Guadalupe River (Spring Branch, Texas) increased from $7.27 \text{ m}^3/\text{s}$ in Period I (1927-1964) to $14.04 \text{ m}^3/\text{s}$ in Period II (1965-2007) with annual frequency of small ($95 \text{ m}^3/\text{s}$) and large ($837 \text{ m}^3/\text{s}$) flood events increasing from 0.81 to 1.07 between periods (Figure 1.2). In the lower Guadalupe River, mean annual flow at New Braunfels, Texas, increased from $9.70 \text{ m}^3/\text{s}$ in Period I (1927-1964) to $17.70 \text{ m}^3/\text{s}$ in

Period II (1965-2007) with annual frequency of small ($120 \text{ m}^3/\text{s}$) and large ($949 \text{ m}^3/\text{s}$) floods decreasing from 0.84 to 0.42. Also in the lower Guadalupe River, mean annual flow at Victoria, Texas, increased from $48.10 \text{ m}^3/\text{s}$ in Period I (1938-1964) to $64.01 \text{ m}^3/\text{s}$ in Period II (1965-2007) with annual frequency of small ($569 \text{ m}^3/\text{s}$) and large ($1,461 \text{ m}^3/\text{s}$) floods decreasing from 0.56 to 0.42. In the San Marcos River, mean annual flow at Luling, Texas increased from $9.55 \text{ m}^3/\text{s}$ in Period I (1938-1963) to $13.31 \text{ m}^3/\text{s}$ in Period II (1976-2007) with annual frequency of small ($143 \text{ m}^3/\text{s}$) and large ($490 \text{ m}^3/\text{s}$) floods decreasing from 0.87 to 0.70 (Figure 3).

Fish Assemblage Changes-Guadalupe River

A total of 78 species were reported in the Guadalupe River mainstem (Table 1). Among the 190 collections retained for analysis, 69 species and 41,869 individuals were taken from the Guadalupe River mainstem from 1938 to 2000. Cyprinidae were most abundant (69% in relative abundance), followed by Centrarchidae (11%), Poeciliidae (6%), Percidae (5%), Catostomidae (2%) and Ictaluridae (2%). Among marine-derived taxa, *Mugil cephalus*, *Mugil curema* and *Achirus lineatus* were not considered significant freshwater components of the assemblage. Guadalupe River mainstem assemblage consisted of two basin endemics (*Dionda nigrotaeniata* and *Percina apristis*), disjunct populations of two fishes (*Erimyzon sucetta* and *Percina shumardi*), southwestern natural distributional extent, along with the adjacent and connected San Antonio River, of seven species (*Macrhybopsis marconis*, *Fundulus notatus*, *Lepomis humilis*, *Micropterus punctulatus*, *Micropterus treculii*, *Etheostoma chlorosoma*, and *Etheostoma spectabile*),

and 15 introduced species (or 22 introduced species of $N = 78$ fishes reported in the drainage). Relative abundance of introduced fishes was $<6\%$ of the total fish assemblage.

Within the upper Guadalupe River, Cyprinidae were most abundant (73% in relative abundance), followed by Percidae (8.1%), Poeciliidae (7.3%), and Centrarchidae (7.1%). Assemblages were similar between Period I (1938 – 1963) and Period II (1965 – 1997). Taxa richness declined from Period I ($S = 42$) to Period II ($S = 41$), and diversity decreased from Period I ($1 - D = 0.86$) to Period II ($1 - D = 0.74$). However, assemblage similarity did not differ between periods (Bray-Curtis index = 37.4%; ANOSIM global $R = 0.079$, $P = 0.08$). Multi-dimensional scaling (MDS) plot and trajectory plot indicated Period II collections were nested within Period I collections (Figure 4). Despite overall assemblage similarities between periods, population changes were found in 10 taxa. Three cyprinids (*Cyprinella venusta*, *Notropis amabilis*, *Notropis volucellus*), two centrarchids (*Micropterus treculii*, *Lepomis auritus*) and one catostomid (*Moxostoma congestum*) increased in relative abundance, collectively increasing from 30% in Period I to $>75\%$ in Period II. Three cyprinids (*Cyprinella lutrensis*, *Macrhybopsis marconis*, and *Pimephales vigilax*) and one percid (*Etheostoma spectabile*) decreased in relative abundance, collectively decreasing from 41% in Period I to $<5\%$ in Period II. Two joinpoints were the most parsimonious models for increasing ($P < 0.01$) and decreasing ($P < 0.01$) populations. For increasing taxa, two joinpoints in 1961 denoted two distinct regression models with independent variables ranging from 1938 – 1961 and 1961 – 1997 (Figure 5). Relative abundances were not associated with either time interval ($b_1 \neq 0$, $P > 0.75$). For decreasing taxa, a joinpoint in 1950 and one in 1961 denoted three distinct regression models with independent variables ranging from 1938 – 1950, 1950 – 1961,

and 1961 – 1997. Relative abundance was negatively associated ($b_1 = -0.000259$, $P < 0.01$) with time period 1950 – 1961.

Within the lower Guadalupe River, Cyprinidae were most abundant (68%), followed by Centrarchidae (13%), Poeciliidae (4.8%), and Catostomidae (3.0%). Differences were found in the fish assemblage between periods. Taxa richness increased between Period I ($S = 40$) and Period II ($S = 62$), and diversity decreased between Period I ($1 - D = 0.92$) and Period II ($1 - D = 0.82$). Fish assemblage similarity differed between periods (Bray-Curtis index = 25%; ANOSIM global $R = 0.409$, $P < 0.01$). Multi-dimensional scaling plot and trajectory plot indicated that assemblages in Period I were segregated from those of Period II (Figure 4). Differences in the fish assemblages were attributed, in part, to increases in non-native fish occurrences ($N = 13$) between periods and to changes in relative abundances. Three centrarchids (*Lepomis macrochirus*, *L. megalotis*, and *Micropterus salmoides*), one catostomid (*Ictiobus bubalus*) and one clupeid (*Dorosoma cepedianum*) increased in relative abundance, collectively increasing from <4% in Period I to >10% in Period II. Two poeciliids (*Gambusia affinis* and *Poecilia latipinna*), two percids (*Percina carbonaria* and *P. apristis*), one cyprinid (*Notropis buchanani*), and one fundulid (*Fundulus notatus*) decreased in relative abundance, collectively decreasing from 27% in Period I to 6% in Period II. Two joinpoints was the most parsimonious model for increasing populations ($P < 0.01$), whereas one linear regression model (i.e., no joinpoint) was the most parsimonious model for decreasing populations ($P = 0.04$; Figure 5). For increasing taxa, one joinpoint in 1995 and another in 1997 denoted three distinct regression models with independent variables ranging from 1950 – 1995, 1995 – 1997, and 1997 – 2000. Relative abundance

was positively associated ($b_1 = 0.000715$, $P < 0.01$) with time only during 1995 – 1997.

For decreasing taxa without a joinpoint, relative abundance was negatively associated ($b_1 = -0.000063$, $P < 0.01$) with time during 1950 – 2000.

Fish Assemblage Changes-San Marcos River

Sixty-six species and 58,727 individuals were taken in 94 collections from the San Marcos River from 1938 to 2006 (Table 2). Poeciliidae were most abundant (66%), followed by Cyprinidae (17%), Centrarchidae (10%) and Percidae (<7%). San Marcos River fish assemblage consisted of one endemic (*Gambusia georgei*), three basin endemics (*Dionda nigrotaeniata*, *Percina apristis*, and *Etheostoma fonticola*), disjunct populations of two fishes (*Percina shumardi*, sympatric with those in the Guadalupe River, and *Notropis chalybaeus*), five fishes with southwestern natural distributional extent in the Guadalupe River drainage (*Macrhybopsis marconis*, *Fundulus notatus*, *Micropterus punctulatus*, *Micropterus treculii*, and *Etheostoma spectabile*), and 16 introduced species of fish. Relative abundance of introduced fishes represented <7% of the total fish assemblage. Currently, one species (*Ictalurus lupus*) is reported as extirpated (Kelsch and Hendricks 1990) and another (*Gambusia georgei*) is considered extinct (Miller et al. 1989).

Differences in the San Marcos River fish assemblage were found between Period I (1938 – 1963) and Period II (1975 – 2006). Taxa richness increased between Period I ($S = 48$) to Period II ($S = 58$), and diversity decreased between Period I ($1 - D = 0.91$) and Period II ($1 - D = 0.80$). Fish assemblage similarity differed between periods (Bray-Curtis index = 27%; ANOSIM global $R = 0.19$, $P < 0.01$). Multi-dimensional scaling plot

and trajectory plot indicated that assemblages in Period I were segregated from those of Period II (Figure 4). Fish assemblage differences were attributed, in part, to increases in non-native fish occurrences ($N = 8$) between periods and to changes in relative abundances. A total of 19 taxa, including one clupeid (*Dorosoma cepedianum*), one catostomid (*Moxostoma congestum*), four cyprinids (*Campostoma anomalum*, *Notropis amabilis*, *N. chalybaeus*, *N. volucellus*), five non-native taxa (*Astyanax mexicanus*, *Hypostomus* sp., *Ambloplites rupestris*, *Lepomis auritus*, *Micropterus dolomieu*), six native centrarchids (*Lepomis gulosus*, *L. macrochirus*, *L. miniatus*, *Micropterus punctulatus*, *M. salmoides*, *M. treculii*), one ictalurid (*Ictalurus punctatus*) and one percid (*Etheostoma spectabile*) increased in abundance, collectively increasing from 13% in Period I to 15% in Period II. Three cyprinids (*Cyprinella lutrensis*, *Macrhybopsis marconis*, and *Pimephales vigilax*), two percids (*Percina carbonaria* and *Etheostoma fonticola*), one ictalurid (*Noturus gyrinus*), and one introduced cichlid (*Cichlasoma cyanoguttatum*) decreased in abundance, collectively decreasing from >48% in Period I to <5% in Period II. Two joinpoints were the most parsimonious model for increasing populations ($P < 0.01$) and one joinpoint was the most parsimonious model for decreasing populations ($P < 0.01$; Figure 5). For increasing taxa, two joinpoints in 1993 denoted two distinct regression models with independent variables ranging from 1938 – 1993 and 1993 – 2006. Relative abundance was positively associated ($b_1 = 0.000021$, $P < 0.01$) with time during 1938 – 1993 and negatively associated ($b_1 = -0.000040$, $P < 0.01$) with time during 1993 – 2006. For decreasing taxa, one joinpoint in 1950 denoted two distinct regression models with independent variables ranging 1938 – 1950 and 1951

– 2006. Relative abundance was negatively associated ($b_1 = -0.000029$, $P < 0.01$) with time only during 1951 – 2006.

Reproductive and trophic guilds changes

Changes in reproductive guilds and trophic guilds were assessed for the lower Guadalupe River and San Marcos River, the two fish assemblages that showed significant assemblage differences between periods according to ANOSIM. Among the 24 fishes with increasing populations through time, reproductive guilds consisted of 59% nest builders, 33% open substrate spawners, and 8% brood hiders; trophic guilds consisted of 54% invertivores, 17% predators, 13% omnivores, 12% herbivores, and 4% detritivores. Among the 13 fishes with decreasing populations through time, reproductive guilds consisted of 30% brood hiders, 23% open substrate spawners, 15% nest builders, 15% internal bearers, and 16% substrate choosers; trophic guilds consisted of 77% invertivores, 15% omnivores, and 8% herbivores.

DISCUSSION

Occurrence and abundance of fishes changed in the Guadalupe River and San Marcos River during a span of about 70 years. During this same time period, characteristics of river discharge were modified; specifically, mean annual flow increased and frequency of small and large flood events generally decreased. Increases in mean annual flows among all three reaches of this study were attributed to computational effects of low water years in 1950s, often described as the drought of record (1949 – 1959; Loaiciga et al. 2000), and to the effects Canyon Lake Reservoir. Discharge during the drought of record represented 25% to 35% of daily discharge records in period I,

lowering the average mean annual flow estimates. Consequently, we suspect that mean annual flows have not meaningfully increased in the upper Guadalupe River or San Marcos River. In contrast, detected increases in mean annual flows are meaningful in the lower Guadalupe River because of water releases at Canyon Lake Reservoir. Canyon Lake Reservoir, operated by US Army Corp of Engineers, regulates discharge releases as part of the reservoir management plan for flood control and recreational activities (Gillig et al. 2001). Likewise, decreases in frequency of small and large flood events were attributed to Canyon Lake Reservoir in the lower Guadalupe River, with effects more noticeable at the nearest downstream Station (08168500). In the San Marcos River, decreases in frequency of small flood events were attributed to flow retarding and retention structures in the San Marcos watershed (Woods and Earl 2002). Interestingly, significant differences in fish assemblage similarities are associated with river reaches that experienced decreases in frequency of small and large flood events (i.e., lower Guadalupe River and San Marcos River).

Fish assemblage changes associated with reductions in frequency of small and large flood events are well documented in temperate and tropical rivers, streams, and small tributaries (Gehrke et al. 1999; Bunn and Arthington 2002; Agostinho et al. 2004; Roy et al. 2005; Mercano-Silva et al. 2006). Reduction in flood frequency affects stream geomorphology, causing a shift toward lentic-type habitat (Poff et al. 1997), contributing to a replacement effect of fluvial specialist with lentic-type, generalist species (Scott and Helfman 2001; Haxton and Findlay 2008). Decreasing abundance of fluvial specialist species occurs through numerous mechanisms, including reduced reproductive success (Durham and Wilde 2006), loss of spawning cues (Bunn and Arthington 2002), barriers

to dispersion (Luttrell et al. 1999) and competitive exclusion from resources (Higgins and Strauss 2008). Subsequent replacement by generalist species occurs through numerous mechanisms as well, including refugia from flood displacement (Steven et al. 2007), fulfillment of void niches (Winston et al. 1991) and increased sedimentation (Poff et al. 1997; Scott and Helfman 2001).

Assemblage changes in the lower Guadalupe River and San Marcos River are consistent with general trends in generalist fish replacements. Within and outside of western gulf slope drainages, generalist fishes are those typically becoming more abundant in areas of flow alterations and include clupeids, some cyprinids, catostomids, poeciliids and centrarchids, whereas fluvial species tend to become less abundant, such as several species of cyprinids, percids and catostomids (Winston et al. 1991; Kingsolving and Bain 1993; Travnicek et al. 1995; Scott and Helfman 2001; Li and Gelwick 2005; Mercado-Silva et al. 2006; Runyan 2007). In this study, abundances of one clupeid, four cyprinids, one catostomid, and 10 centrarchids increased through time in the lower Guadalupe River and San Marcos River. Correspondingly, abundances of fluvial specialist (i.e., 3 percids and 2 cyprinids) decreased through time in the lower Guadalupe River and San Marcos River. Exact mechanisms of these replacements are not known, but likely related to changes in fluvial specialist habitats and reductions in displacement floods as reported in other studies (Valdez et al. 2001; Herbert and Gelwick 2003; Holden et al. 2005; Watson 2006). Effects of displacement floods on generalist fishes were demonstrated by the results of this study. In the San Marcos River, taxa considered increasing from 1938 to 1993, specifically generalist fishes (i.e., *Lepomis auritus*, *Lepomis gulosus*, *Lepomis macrochirus*, *Micropterus salmoides* and *Ictalurus punctatus*),

abruptly decreased from 1993 to 2006. These abundance declines occurred during a period of six large flood events including a catastrophic flood in 1998.

There were inconsistencies with general trends in generalist fish replacements in the lower Guadalupe River and San Marcos River. Poeciliid abundances are expected to increase with decreases in frequency of flood events in western gulf slope drainages (Ward et al. 2003), but they actually decreased through time in the lower Guadalupe River. Similar trends of decreasing abundance through time were observed for *Gambusia affinis* in the San Antonio River (Runyan 2007) and for *Poecilia latipinna* in the upper Guadalupe River (Stevens et al. 2007 and this study). Stevens et al. (2007) suggested that a single flood was responsible for population declines, if not extirpation, of *P. latipinna* in the upper Guadalupe River. As the authors noted, a similar response occurred with another poeciliid during a flood in a Sonoran Desert stream (Collins et al. 1981).

Another inconsistency in general trends in generalist fish replacements is that abundances of several fluvial specialists (*N. amabilis*, *N. volucellus*, and *N. chalybaeus*) increased through time, whereas abundances of taxa typically associated with flow altered systems, generalist species with broad tolerances (*Cyprinella lutrensis*, *Pimephales vigilax* and *Etheostoma spectabile*; Matthews 1985; Greenburg 1989; Li and Gelwick 2005; Runyan 2007) decreased through time in the San Marcos River. Similar results were observed in the upper Guadalupe River; *C. lutrensis*, *P. vigilax*, and *E. spectabile* decreased through time, specifically from 1950 through 1961. Based on the timing of abundance declines in these more tolerant taxa in the upper Guadalupe River, we propose that fish collections during the drought of record reflected a stressed system with an abundance of tolerant taxa. With the return of average precipitation and consequently average stream discharge

post 1959, fluvial specialists again proliferated whereas tolerant taxa declined.

Proliferation of the natural fish assemblage does occur in streams once the natural environment returns or is restored, assuming source populations exist and recolonization is not impeded by instream structures (Kinsolving and Bain 1993; Doyle et al. 2005).

Despite alteration of flow regime in the lower Guadalupe River and San Marcos River, fish assemblages within all three reaches of this study remain intact. Relative to streams with similar alteration, the worldwide pattern of loss of diversity and ecosystem function, decline in fluvial specialist abundance and replacement by generalist species are of lower magnitude in the lower Guadalupe River and San Marcos River. For example, the Petit-Saut Dam on the Sinnamary River in French Guiana significantly altered assemblage diversity and trophic structure downstream (de Merona et al. 2005), however we saw few significant changes in trophic structure in the lower Guadalupe and San Marcos rivers. Over-exploitation of water in the Laja River of central Mexico caused significant alteration of assemblage composition with a 20 to 22% increase in exotic species (Mercado-Silva et al. 2006); we found exotics were < 6% within the Guadalupe mainstem and < 7% within the San Marcos River. Our study did not indicate full replacement by generalist species, yet hydrologic alterations in the Virgin-Moapa River System of the southwestern USA resulted in decline of native fish fauna and virtually complete replacement by *C. lutrensis* in some portions (Holden et al. 2005). We attribute changes in the mainstem Guadalupe River to changes in species abundance as well as introduction of exotic species through sportfish stockings in Canyon Reservoir. In the Big Blue River, Kansas habitat generalist species (e.g., *Pimephales vigilax*, *Gambusia affinis*) increased in abundance whereas fluvial specialist species (e.g., *Macrhybopsis*

hyostoma) declined in abundance or become extirpated altogether, and sportfish related activities within impounded portions of the river facilitated introduction of numerous taxa (Gido et al. 2002). Similar to our study, the fish assemblage of the Big Blue River remained relatively stable over the course of 40 years, despite natural inter-annual variation (Gido et al. 2002).

Though the Guadalupe River and San Marcos River fish assemblages remain relatively intact, extinctions, extirpations and introductions have occurred independently and dependently of flow alteration and riverscape fragmentation. Presumed extirpated *Ictalurus lupus* and extinct *Gambusia georgei* of the San Marcos River declined in response to exotic species and sportfish introductions (Miller et al. 1989; Kelsch and Hendricks 1990). Exotic suckermouth catfish in the upper San Marcos River were introduced from the aquarium trade and likely contribute to native taxa decline through competition (Cohen 2008; Cook-Hildreth 2008). Introduction of exotic sportfishes and subsequent bait bucket releases in Canyon Lake Reservoir increased species richness in the Guadalupe River after impoundment. Introduction and proliferation of exotic sportfish and baitfish in the Big Blue River contributed to increased species richness following impoundment, and proliferation of such species was dependent, in part, upon altered flow regime (Gido et al. 2002). Changes more directly coupled to riverscape fragmentation and subsequent flow regime alteration include abundance declines for substrate choosing darters (e.g., *Percina carbonaria* and *P. apristis*) and broadcast spawning minnows (e.g., *Macrhybopsis marconis*). Flow regime alteration of other Western Gulf Slope drainages caused abundance declines for substrate choosers and broadcast spawners following reduction in flood frequencies and subsequent shifts in

habitat availability (Runyan 2007). Riverscape fragmentation is most detrimental to members of the genus *Macrhybopsis* and declines or extirpations related to fragmentation have occurred in Oklahoma (Winston et al. 1991), Arkansas (Luttrell et al. 1999), Kansas (Gido et al. 2002), Texas (Runyan 2007, this study), and Mississippi (Taylor et al. 2008). Concern for future loss of biodiversity in the Guadalupe River and San Marcos River exist for species with limited geographic range (e.g., *Macrhybopsis marconis*, *Dionda nigrotaeniata* and *Etheostoma fonticola*) as well as species of special concern ($N = 7$ Guadalupe River, $N = 7$ San Marcos River; Hubbs et al. 2008).

Knowledge of long-term ichthyological responses to altered flow regime at both the species and assemblage level further improves our ability to predict responses to future threats as well as future conservation plans. For example, Detenbeck et al. (1992) suggested that spawning habitat was a key factor in determining how quickly species recolonize after flood disturbances; specifically, nest-spawning generalist require significantly longer periods for reconlonization. Aarts et al. (2004) and Doyle et al. (2005) found return of spawning habitat after removal of anthropogenic disturbances (e.g., dam removal) was the limiting factor for recolonization of fluvial specialist taxa. Consequently, proposed low-head dam removal on the San Marcos River likely would improve within-stream movement. Poff and Ward (1989) classified the San Marcos River as a perennial flashy system in which floods are important components in determining community structure, and when floods are reduced competitive interactions determine assemblage structure. Such competitive interactions generally result in locally endemic species being out-competed by exotic or introduced species (Rahel 2000), which are numerous in the San Marcos River ($N = 16$; Hubbs et al. 2008). However, the

observed relatively small magnitude of assemblage structure alteration following flood removal from both lower Guadalupe River and San Marcos River is likely explained by the resilient nature of stream fish assemblages (Pearsons et al. 1992).

Table 1.1: Native status, mean relative abundance per time period, population trend and associated P-value, primary and secondary reproductive guild, and trophic guild for species collected in the upper and lower Guadalupe River. Native status was determined by Hubbs et al. (2008) as native (N) or introduced (I). Time period I (1938-1963) represents ichthyological collections leading up to the impoundment of Canyon Reservoir and time period II (1965-2000) after impoundment; 'X' indicates rarely reported species. Population trends are increasing (↑), decreasing (↓), stable (S) and indeterminable (-); P-values are reported only for species indicating significant population change. Reproductive guilds follow Simon (1999) and trophic guilds are detritivore (D), herbivore (H), invertivore (IF), omnivore (O), piscivore (P) and planktivore (PL; Goldstein and Simon 1999).

Species	Status	Upper Guadalupe River				Lower Guadalupe River				Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
		Period I	Period II	Population Trend	P-value	Period I	Period II	Population Trend	P-value			
<i>Atractosteus spatula</i> ^a	N			-				-		Open Substratum	Phytophil	P
<i>Lepisosteus oculatus</i>	N	0 01		-		0 20	0 34	S		Open Substratum	Phytophil	P
<i>Lepisosteus osseus</i>	N	0 62	0 10	-		0 08	0 03	-		Open Substratum	Phytolithophil	P
<i>Anguilla rostrata</i>	N			-		0 10	0 02	-		Catadromous	Catadromous	P
<i>Dorosoma cepedianum</i>	N	1 38	1 86	S		0 34	3 27	↑	0 013	Open Substratum	Lithopelagophil	H
<i>Dorosoma petenense</i>	N		0 10	-			<0 01	-		Open Substratum	Phytophil	PL
<i>Campostoma anomalum</i>	N	2 39	2 53	S		0 10	0 73	S		Brood Hiders	Lithophil	H
<i>Carassius auratus</i> ^a	I			-				-		Open Substratum	Phytophil	IF
<i>Ctenopharyngodon idella</i> ^a	I			-				-		Open Substratum	Pelagophil	H
<i>Cyprinella lutrensis</i>	N	21 53	1 10	↓	<0 001	22 16	35 15	S		Brood Hiders	Speleophil	IF
<i>Cyprinella venusta</i>	N	23 12	47 41	↑	<0 001	0 24	3 86	S		Brood Hiders	Speleophil	IF
<i>Cyprinus carpio</i>	I		0.67	-			0 87	-		Open Substratum	Phytolithophil	O
<i>Dionda nigrotaeniata</i>	N	0 02	0.12	-				-		Open Substratum	Lithophil	H
<i>Macrhybopsis marconis</i>	N	1 80	0.27	↓	0 025	3 87	1 51	S		Open Substratum	Pelagophil	IF
<i>Notemigonus crysoleucas</i> ^b	N		X	-			X	-		Open Substratum	Phytophil	IF
<i>Notropis amabilis</i>	N	3 24	10 48	↑	<0 001	3 54	7 39	S		Open Substratum	Pelagophil	IF
<i>Notropis buchanani</i>	N	0 07		-		5 34	0 68	↓	0 001	Open Substratum	Pelagophil	IF
<i>Notropis stramineus</i>	N	1 42	0.14	S		0 10	0 15	-		Open Substratum	Lithophil	IF
<i>Notropis volucellus</i>	N	2 71	12 20	↑	<0 001	4 74	3 39	S		Open Substratum	Phytophil	O
<i>Opsopoeodus emiliae</i>	N			-		0 29	0 72	-		Nest	Speleophil	DT

Table 1.1 continued.

Species	Status	Upper Guadalupe River				Lower Guadalupe River				Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
		Period I	Period II	Population Trend	P-value	Period I	Period II	Population Trend	P-value			
<i>Pimephales promelas</i>	I	0.01		-				-		Nest	Speleophil	O
<i>Pimephales vigilax</i>	N	3.16	0.40	↓	0.027	7.86	3.43	S		Nest	Speleophil	O
<i>Carpododes carpio</i>	N	0.43	0.04	-				-		Open Substratum	Lithopelagophil	DT
<i>Cycleptus elongatus</i> ^a	N			-				-		Open Substratum	Lithopelagophil	IF
<i>Ermyzon sucetta</i>	N	0.02		-				-		Open Substratum	Phytolithophil	IF
<i>Ichobus bubalus</i>	N			-			1.02	↑	0.017	Open Substratum	Lithopelagophil	O
<i>Moxostoma congestum</i>	N	1.22	1.29	↑	0.001	0.57	3.73	S		Open Substratum	Lithophil	IF
<i>Astyanax mexicanus</i>	I	0.33	0.05	-			1.34	S		Open Substratum	Pelagophil	IF
<i>Amenurus melas</i>	N	0.01		-				-		Nest	Speleophil	IF
<i>Amenurus natalis</i>	N	0.19	0.03	-		0.03	0.40	-		Nest	Speleophil	IF
<i>Amenurus nebulosus</i> ^a	I			-				-		Nest	Speleophil	IF
<i>Ictalurus furcatus</i> ^b	N	X	X	-		X	X	-		Nest	Speleophil	P
<i>Ictalurus lupus</i>	N	0.06	0.02	-				-		Nest	Speleophil	O
<i>Ictalurus punctatus</i>	N	1.91	1.16	S		2.59	1.88	S		Nest	Speleophil	O
<i>Noturus gyrinus</i>	N			-		0.25	<0.01	-		Nest	Speleophil	IF
<i>Pylodictus olivaris</i>	N	0.34	0.04	S		0.16	0.23	S		Nest	Speleophil	IF
<i>Hypostomus sp.</i> ^a	I			-				-		Nest	Speleophil	DT
<i>Oncorhynchus mykiss</i>	I			-			0.04	-		Brood Hiders	Lithophil	IF
<i>Salmo trutta</i>	I			-			<0.01	-		Brood Hiders	Lithophil	IF
<i>Fundulus grandis</i> ^a	N			-				-		Open Substratum	Phytophil	O
<i>Fundulus notatus</i>	N			-		2.18	0.21	↓	0.011	Open Substratum	Phytophil	H
<i>Gambusia affinis</i>	N	8.81	3.81	S		6.90	3.07	↓	0.026	Internal Bearer	Viviparous	IF
<i>Poecilia latipinna</i> ^c	N	0.05		-		5.29	0.60	↓	0.013	Internal Bearer	Viviparous	O
<i>Membras martinica</i> ^a	I			-				-		Open Substratum	Phytophil	O
<i>Menidia beryllina</i>	I		0.27	-			0.97	S		Open Substratum	Phytophil	IF

Table 1.1 Continued

Species	Status	Upper Guadalupe River				Lower Guadalupe River				Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
		Period I	Period II	Population Trend	P-value	Period I	Period II	Population Trend	P-value			
<i>Morone chrysops</i> ^b	I		X	-			X	-		Open Substratum	Phytolithophil	P
<i>Morone saxatilis</i>	I			-			0.02	-		Open Substratum	Phytolithophil	P
<i>Ambloplites rupestris</i>	I	0.01		-	<0.001		0.72	S		Nest	Polyphil	IF
<i>Lepomis auritus</i>	I	1.12	2.19	↑			2.90	S		Nest	Polyphil	IF
<i>Lepomis cyanellus</i>	N	0.70	0.60	S		0.13	1.28	S		Nest	Polyphil	IF
<i>Lepomis gulosus</i>	N	0.50	0.12	S		1.12	0.25	S		Nest	Lithophil	IF
<i>Lepomis humilis</i>	N			-			0.07	-		Nest	Lithophil	IF
<i>Lepomis macrochirus</i>	N	0.66	1.73	S		0.74	4.52	↑	0.001	Nest	Polyphil	IF
<i>Lepomis megalotis</i>	N	1.97	1.84	S		1.95	5.98	↑	<0.001	Nest	Polyphil	IF
<i>Lepomis microlophus</i>	I	0.20	0.35	S			0.52	S		Nest	Polyphil	IF
<i>Lepomis miniatus</i>	N	0.51	0.07	S			0.38	S		Nest	Polyphil	IF
<i>Micropterus dolomieu</i>	I			-			0.69	S		Nest	Polyphil	P
<i>Micropterus punctulatus</i>	N			-		0.10	0.78	S		Nest	Polyphil	IF
<i>Micropterus salmoides</i>	N	0.71	1.39	S		0.25	2.24	↑	<0.001	Nest	Polyphil	P
<i>Micropterus treculii</i>	N	0.54	1.44	↑	<0.001	1.25	0.82	S		Nest	Polyphil	P
<i>Pomoxis annularis</i>	N		0.05	-			0.07	-		Nest	Phytophil	P
<i>Pomoxis nigromaculatus</i>	I			-			0.02	-		Nest	Phytophil	IF
<i>Etheostoma chlorosoma</i>	N			-		0.63	0.03	-		Substratum Chooser	Phytophil	IF
<i>Etheostoma gracile</i>	N			-		0.51		-		Substratum Chooser	Phytophil	IF
<i>Etheostoma lepidum</i>	N	2.08	0.92	S		0.52	0.17	S		Brood Hiders	Lithophil	IF
<i>Etheostoma spectabile</i>	N	11.03	2.91	↓	0.028	1.58	0.37	S		Brood Hiders	Lithophil	IF
<i>Percina carbonaria</i>	N	2.05	1.32	S		4.60	0.09	↓	<0.001	Brood Hiders	Lithophil	IF
<i>Percina macrolepida</i>	N			-		0.46	0.04	-		Brood Hiders	Lithophil	IF
<i>Percina apristis</i>	N	0.42		-		2.12	0.16	↓	<0.001	Brood Hiders	Lithophil	IF
<i>Percina shumardi</i>	N	0.07		-		2.71	0.13	-		Brood Hiders	Lithophil	IF

Table 1.1 Continued

Species	Status	Upper Guadalupe River				Lower Guadalupe River				Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
		Period I	Period II	Population	P-value	Period I	Period II	Population	P-value			
<i>Stizostedion vitreum</i> ^b	I		X	-			X	-		Substratum Chooser	Lithopelagophil	P
<i>Cichlasoma cyanoguttatum</i>	I	0.48	0.28	S		1.39	1.52	S		Substratum Chooser	Lithophil	IF
<i>Oreochromis aureus</i> ^b	I		X	-			X	-		Bearer	Mouth Brooder	O
<i>Oreochromis mossambicus</i> ^a	I			-				-		Bearer	Mouth Brooder	O
<i>Agonostomus monticola</i>	N			-			0.01	-		Catadromous	Catadromous	O
<i>Mugil cephalus</i>	N			-		0.56	0.08	-		Catadromous	Catadromous	DT
<i>Mugil curema</i>	N			-			<0.01	-		Catadromous	Catadromous	O
<i>Achirus lineatus</i>	N			-			<0.01	-		Catadromous	Catadromous	O
Collections During Period:		86	24			12	68					
Individuals Collected:		12,266	6,626			1,390	21,587					
Taxa Richness:		42	41			40	62					
Diversity:		0.86	0.74			0.92	0.82					

^aOccurs in Drainage (USFWS 1973, Conner and Suttkus 1986, Prentice et al. 1998); not recorded in historical collections and not used in richness nor diversity calculations

^bSpecies reported in Canyon Lake Reservoir (Whiteside 1983-2000, Unpublished Data); included in richness and diversity calculations

^cNative to lower Guadalupe River (Conner and Suttkus 1986); introduced to upper Guadalupe River (Stevens et al. 2007)

Table 1.2: Native status, mean relative abundance per time period, population trend and associated P-value, primary and secondary reproductive guild, and trophic guild for species collected in the San Marcos River. Mean relative abundance is presented for Period I (1938-1969) and Period II (1970-2006). Abbreviations are given in Table 1.

Species	Status	Period I	Period II	Population Trend	P-value	Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
<i>Lepisosteus oculatus</i>	N		0 10	-		Open Substratum	Phytophil	P
<i>Lepisosteus osseus</i>	N		0 09	-		Open Substratum	Phytolithophil	P
<i>Anguilla rostrata</i>	N		0 02	-		Catadromous	Catadromous	P
<i>Dorosoma cepedianum</i>	N	0 17	2 20	↑	0.01	Open Substratum	Lithopelagophil	H
<i>Campostoma anomalum</i>	N	0 13	1 33	↑	0.01	Brood Hiders	Lithophil	H
<i>Carassius auratus</i>	I		0 06	-		Open Substratum	Phytophil	IF
<i>Cyprinella lutrensis</i>	N	14 33	1 45	↓	<0.01	Brood Hiders	Speleophil	IF
<i>Cyprinella venusta</i>	N	5 34	6 50	S		Brood Hiders	Speleophil	IF
<i>Cyprinus carpio</i>	I		0 30	-		Open Substratum	Phytolithophil	O
<i>Dionda nigrotaeniata</i>	N	0 61	1 35	S		Open Substratum	Lithophil	H
<i>Hybopsis amnis</i>	N	0 24		-		Open Substratum	Lithophil	IF
<i>Macrhybopsis marconis</i>	N	2 43	0 37	↓	<0.01	Open Substratum	Pelagophil	IF
<i>Notemigonus crysoleucas</i>	N	0 05	0 27	-		Open Substratum	Phytophil	IF
<i>Notropis amabilis</i>	N	3 73	7 82	↑	0.03	Open Substratum	Pelagophil	IF
<i>Notropis buechanani</i>	N	0 43		-		Open Substratum	Pelagophil	IF
<i>Notropis chalybaeus</i>	N	0 09	0 50	↑	0.01	Open Substratum	Lithopelagophil	IF
<i>Notropis stramineus</i>	N	0 08	0 27	-		Open Substratum	Lithophil	IF
<i>Notropis volucellus</i>	N	1 02	6 89	↑	0.02	Open Substratum	Phytophil	O
<i>Opsopoeodus emiliae</i>	N	<0 01	<0 01	-		Nest	Speleophil	DT
<i>Pimephales promelas</i>	I	0 03		-		Nest	Speleophil	O
<i>Pimephales vigilax</i>	N	4 68	1 49	↓	0.02	Nest	Speleophil	O
<i>Carpionotus carpio</i>	N	0 13		-		Open Substratum	Lithopelagophil	DT
<i>Ictiobus bubalus</i>	N		0 29	-		Open Substratum	Lithopelagophil	O
<i>Moxostoma congestum</i>	N	0 04	1 63	↑	<0.01	Open Substratum	Lithophil	IF
<i>Astyanax mexicanus</i>	I	0 48	2 01	↑	0.03	Open Substratum	Pelagophil	IF
<i>Ameiurus melas</i>	N	0 10	0 06	-		Nest	Speleophil	IF
<i>Ameiurus natalis</i>	N	0 71	0 36	S		Nest	Speleophil	IF
<i>Ictalurus furcatus</i>	N		0 02	-		Nest	Speleophil	P
<i>Ictalurus lupus</i> ^a	N	0 16		-		Nest	Speleophil	O
<i>Ictalurus punctatus</i>	N	0 54	1 08	↑	0.04	Nest	Speleophil	O
<i>Noturus gyrinus</i>	N	2 95		↓	<0.01	Nest	Speleophil	IF
<i>Noturus nocturnus</i>	N	0 06		-		Nest	Speleophil	IF
<i>Pylodictis olivaris</i>	N		0 12	-		Nest	Speleophil	IF
<i>Hypostomus sp</i>	I		0 02	↑	<0.01	Nest	Speleophil	DT
<i>Fundulus notatus</i>	N	0 61	0 30	S		Open Substratum	Phytophil	H

Table 1.2 continued

Species	Status	Period I	Period II	Population Trend	P-value	Primary Reproductive Guild	Secondary Reproductive Guild	Trophic Guild
<i>Gambusia affinis</i>	N	6 82	6 75	S		Internal Bearer	Viviparous	IF
<i>Gambusia geiseri</i>	N	11 77	9 73	S		Internal Bearer	Viviparous	IF
<i>Gambusia georgei</i> ^b	N	0 79		-		Internal Bearer	Viviparous	IF
<i>Poecilia formosa</i>	I	2 36	0 98	S		Internal Bearer	Viviparous	IF
<i>Poecilia latipinna</i>	I	3 94	2 46	S		Internal Bearer	Viviparous	O
<i>Cyprinodon variegatus</i>	N	0 03		-		Nest	Polyphil	O
<i>Ambloplites rupestris</i>	I	0 27	1 50	↑	<0.01	Nest	Polyphil	IF
<i>Lepomis auritus</i>	I	0 39	5 48	↑	<0.01	Nest	Polyphil	IF
<i>Lepomis cyanellus</i>	N	0 62	1 16	S		Nest	Polyphil	IF
<i>Lepomis gulosus</i>	N	0 21	0 66	↑	0.02	Nest	Lithophil	IF
<i>Lepomis macrochirus</i>	N	2 64	5 19	↑	<0.01	Nest	Polyphil	IF
<i>Lepomis megalotis</i>	N	0 76	3 14	S		Nest	Polyphil	IF
<i>Lepomis microlophus</i>	N	0 51	0 51	S		Nest	Polyphil	IF
<i>Lepomis miniatus</i>	N	3 78	5 37	↑	0.01	Nest	Polyphil	IF
<i>Micropterus dolomieu</i>	I		0 21	↑	0.01	Nest	Polyphil	P
<i>Micropterus punctulatus</i>	N		0 31	↑	<0.01	Nest	Polyphil	IF
<i>Micropterus salmoides</i>	N	1 50	2 12	↑	0.01	Nest	Polyphil	P
<i>Micropterus treculi</i>	N	0 16	0 57	↑	0.04	Nest	Polyphil	P
<i>Pomoxis annularis</i>	I		0 05	-		Nest	Phytophil	P
<i>Pomoxis nigromaculatus</i>	I		0 04	-		Nest	Phytophil	IF
<i>Etheostoma fonticola</i>	N	15 45	2 33	↓	0.03	Substratum Chooser	Phytophil	IF
<i>Etheostoma lepidum</i>	N			-		Brood Hiders	Lithophil	IF
<i>Etheostoma spectabile</i>	N	0 13	0 71	↑	0.01	Brood Hiders	Lithophil	IF
<i>Percina carbonaria</i>	N	0 39	0 09	↓	0.03	Brood Hiders	Lithophil	IF
<i>Percina macrolepida</i>	N		0 09	-		Brood Hiders	Lithophil	IF
<i>Percina apristis</i>	N	2 25	2 28	S		Brood Hiders	Lithophil	IF
<i>Percina shumardi</i>	N	0 05	0 01	-		Brood Hiders	Lithophil	IF
<i>Cichlasoma cyanoguttatum</i>	I	3 83	1 47	↓	0.03	Substratum Chooser	Lithophil	IF
<i>Cichlasoma nigrofasciatum</i>	I		0 03	-		Substratum Chooser	Lithophil	IF
<i>Oreochromis aureus</i>	I		0 19	-		Bearer	Mouth Brooder	O
<i>Oreochromis mossambicus</i>	I		0 03	-		Bearer	Mouth Brooder	O
Collections During Period:		47	47					
Individuals Collected:		10,695	48,032					
Taxa Richness:		48	58					
Diversity:		0.91	0.80					

^aSpecies presumed extirpated (Kelsch and Hendricks 1990)^bSpecies presumed extinct (Miller et al. 1989)

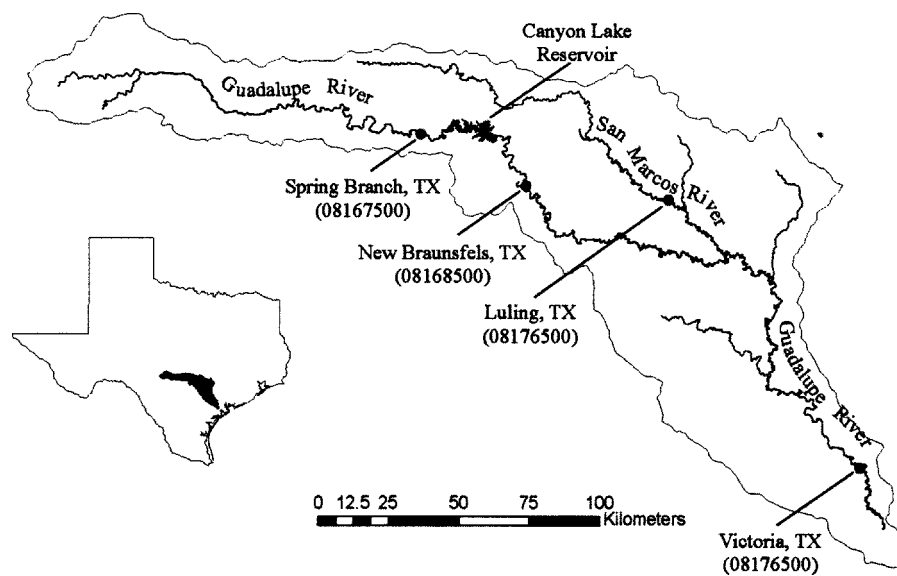


Figure 1.1: Guadalupe River Basin of Texas. Dots represent USGS stream flow gauge locations (station I.D. number) used in Indicators of Hydrologic Alteration (IHA) analysis.

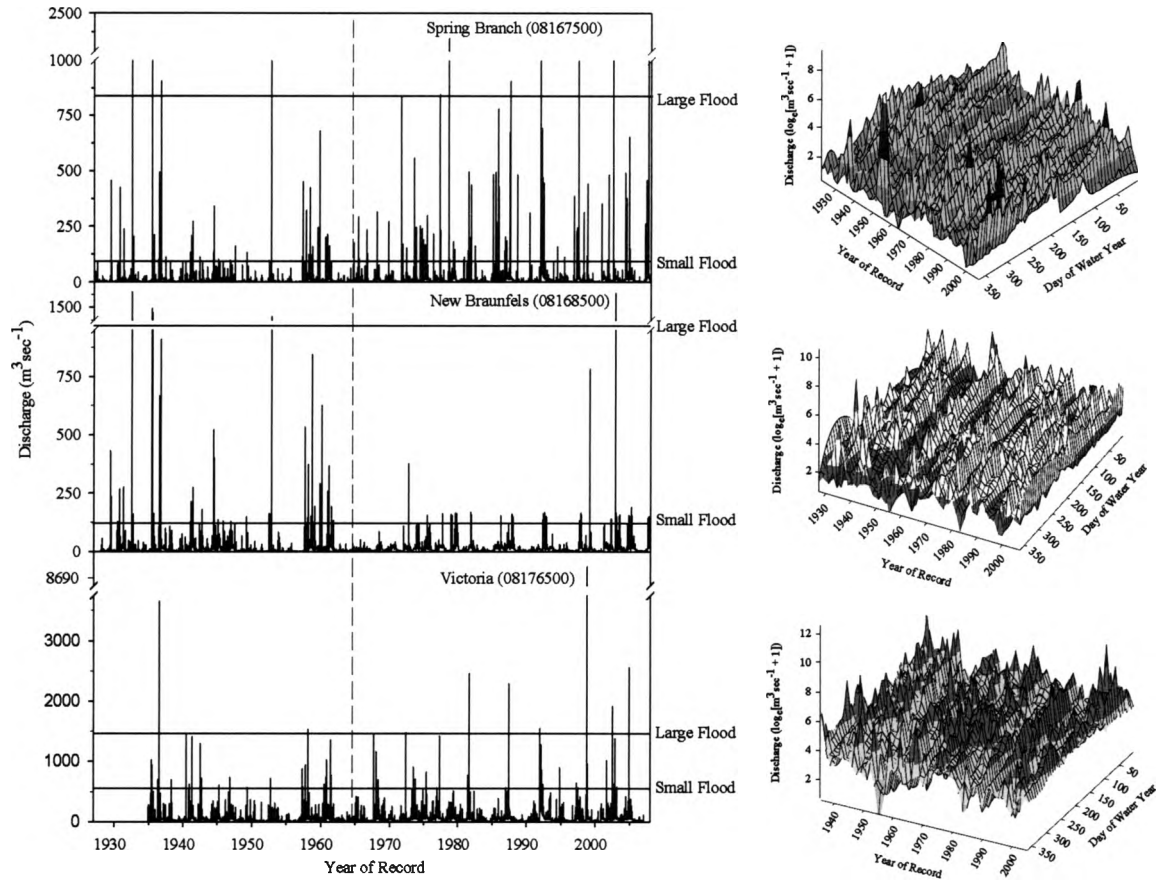


Figure 1.2: Hydrographs and flow histories of the Guadalupe River at Spring Branch, New Braunfels and Victoria, Texas USGS gauging stations. Indicators of Hydrologic Alteration (IHA) was used to assess thresholds and occurrence of large and small floods, vertical dashed line indicates the completion of Canyon Lake Reservoir (1964).

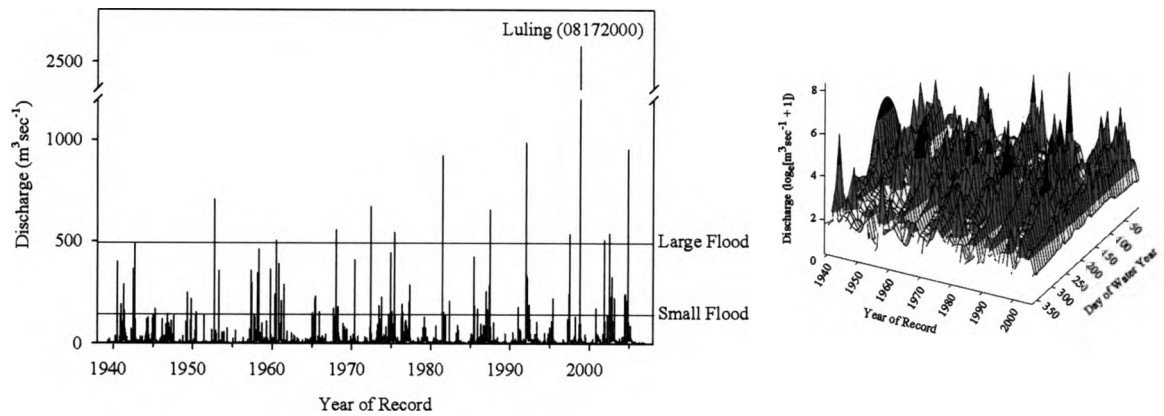


Figure 1.3: Hydrograph and flow history of the San Marcos River at Luling, Texas USGS gauging station. Indicators of Hydrologic Alteration (IHA) was used to assess thresholds and occurrence of large and small floods.

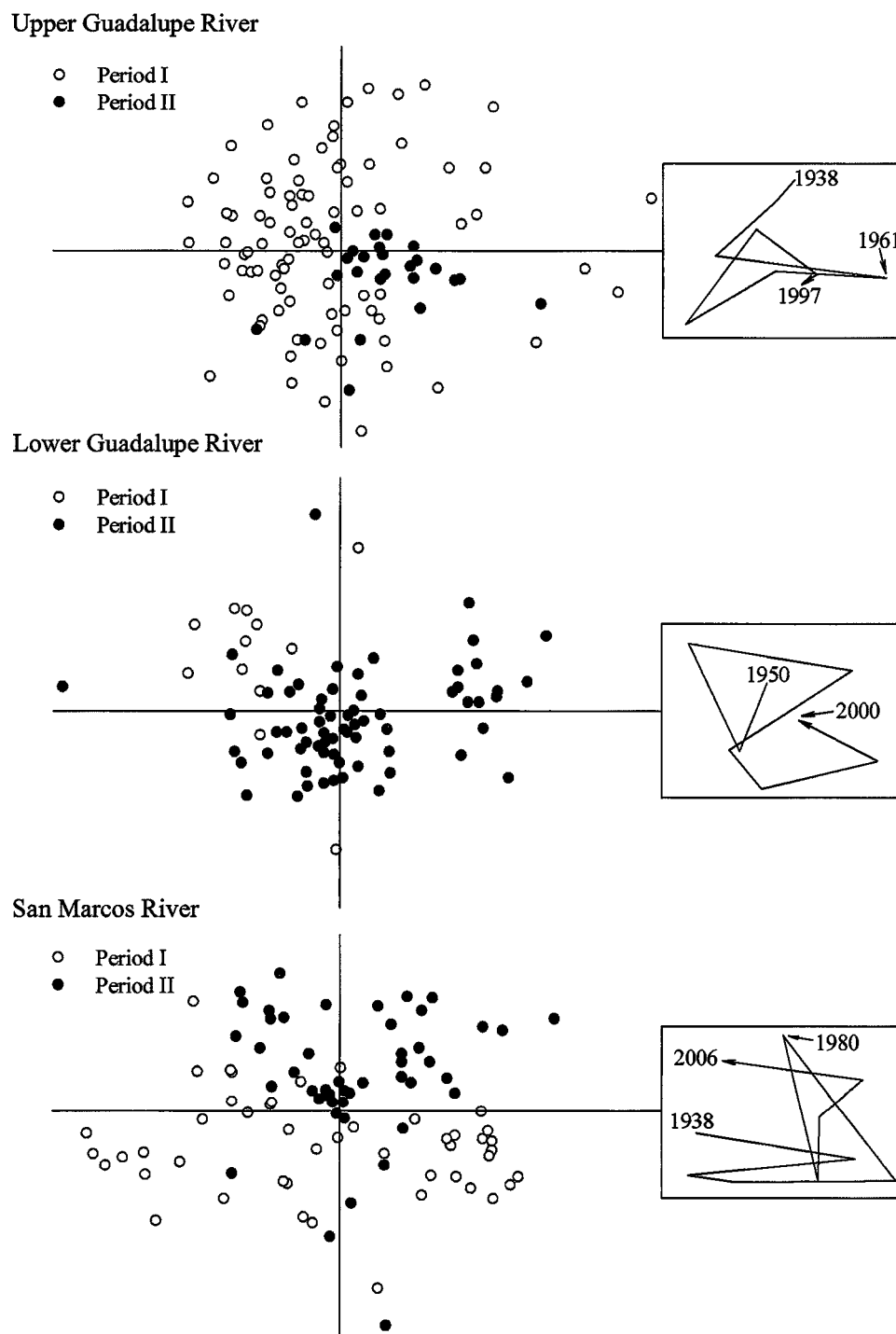


Figure 1.4: Multi-dimensional scaling (MDS) plots and trajectories for upper Guadalupe, lower Guadalupe, and San Marcos River fish assemblages. Points represent ichthyological collections during Period I (open dots) and Period II (closed dots) and are plotted following fourth root transformation of relative abundances; trajectory plots follow 5-year running averages of MDS coordinates.

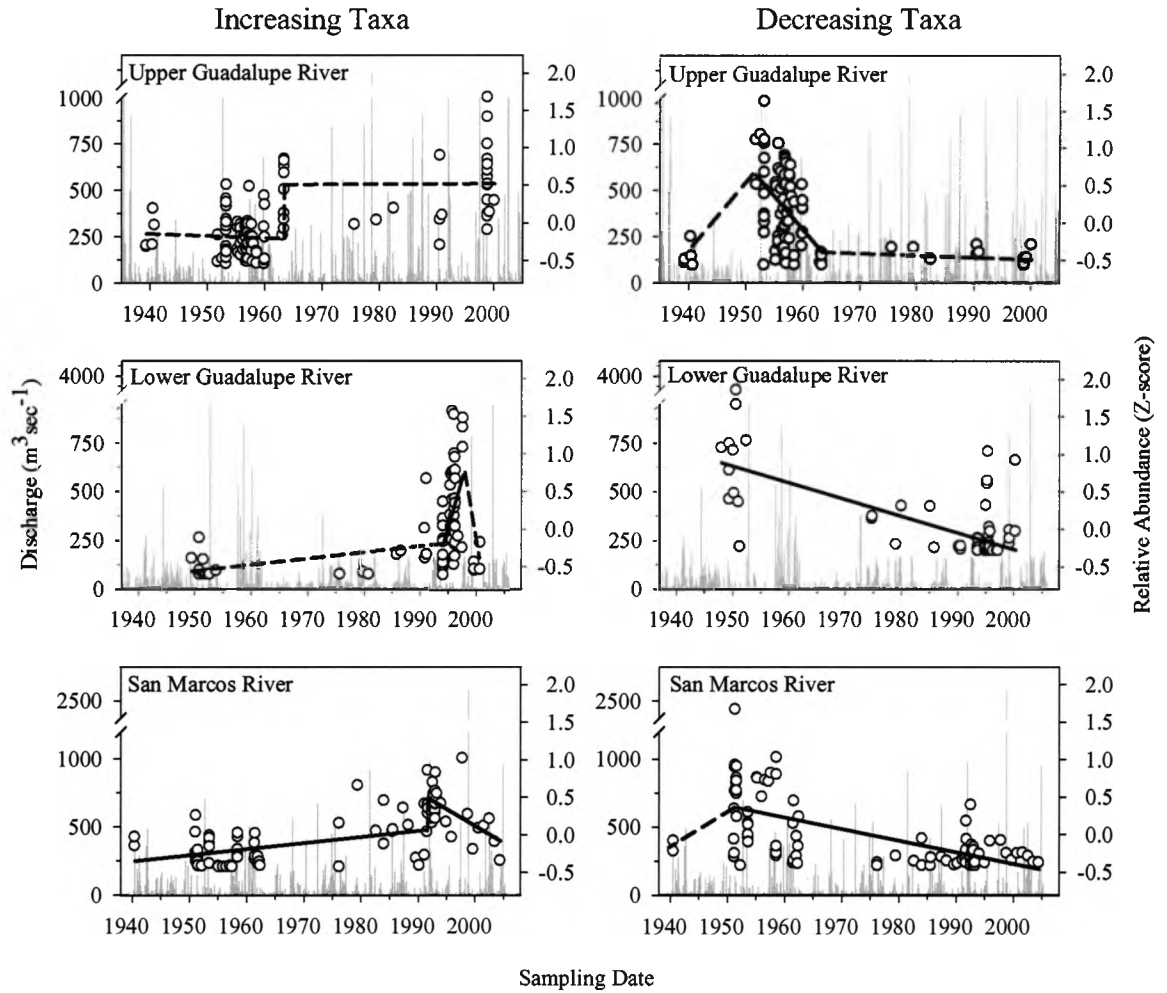


Figure 1.5: Joinpoint regressions for mainstem Guadalupe River and San Marcos River fish assemblages. Open circles represent Z-score transformed mean relative abundance for all species demonstrating significant increasing or decreasing populations. Solid lines indicate significant slopes ($b_1 \neq 0$) and dashed lines indicate non-significant slopes ($b_1 = 0$).

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CHAPTER II

MOVEMENT AND MICROHABITAT ASSOCIATIONS OF GUADALUPE BASS *MICROPTEROUS TRECULII* IN THE PEDERNALES AND SOUTH LLANO RIVERS

INTRODUCTION

Movement among refuge, foraging and spawning habitat is crucial to the completion of stream-dwelling fish life history (Schlosser and Angermeier 1995) and is commonly quantified when developing management plans and conservation initiatives for stream-dwelling *Micropterus* species (Horton and Guy 2002; VanArnum et al. 2004). Movement and habitat associations have been considered in the context of sportfish management (Bangham and Bennington 1939) and are well understood for *Micropterus* species with broad distributions and greater sportfish value (i.e., *M. salmoides*, *M. dolomieu*, *M. punctulatus*). Only more recently have movement and habitat use been considered in the context of conservation for imperiled and rare species. Following declining abundance for some species (*M. punctulatus*; Tillma et al. 1998) and imperilment of others (*M. cataractae*, *M. coosae*, *M. treculii*; Warren et al. 2000), a growing body of research has emerged pertaining to the ecological and evolutionary significance of movement and habitat use for stream-dwelling black basses (Horton and Guy 2002; Koppelman and Garrett 2002; Wheeler and Allen 2003; Stormer 2007)

Members of the genus *Micropterus* inhabit lotic systems (Stormer 2007), where habitat specialization has resulted in unique movement and reproductive habitat associations for each species (Koppelman and Garrett 2002). For example, *M. salmoides* spawn on open nests in deep pools and move on the order of kilometers from overwintering to spawning habitats (Mesing and Wicker 1986; Raibley et al. 1997). Conversely, *M. dolomieu* spawn within overhead cover and generally remain within a single mesohabitat during spawning, but may exhibit long migrations (Todd and Rabeni 1989; Lyons and Kanehl 2002; VanArnum et al. 2004). *Micropterus punctulatus* exhibit little movement (e.g., 18 m/h) and generally remain within or close to a single pool, where spawning occurs on gravel bars (Viosca 1931; Horton and Guy 2002). Movement patterns and habitat associations are least understood for regionally endemic black bass species (*M. cataractae*, *M. coosae*, *M. notius*, *M. treculii*; Koppelman and Garrett 2002; but see Wheeler and Allen 2003 and Stormer 2007). Koppelman and Garrett (2002) suggested the paucity of data for the regionally endemic species has resulted in a poor understanding of the competitive adaptations that allow sympatric occurrence of allopatrically evolved species (*sensu* Near et al. 2003). Furthermore, a clear understanding of movement and habitat partitioning may be helpful in understanding consequences of *Micropterus* species introductions (Jackson 2002) as well as how anthropogenic stream regulation influences competition among sympatrically occurring species (Edwards 1980).

Guadalupe bass *M. treculii* is endemic to western gulf slope drainages of central Texas where it is currently listed as a species of *special concern* due to introgression with introduced smallmouth bass and habitat degradation (Hubbs et al. 2008). Whereas

introgression with smallmouth bass represents the most immediate threat to Guadalupe bass persistence, habitat degradation is the most significant threat (Edwards 1980; Garrett 1991). Introgression with smallmouth bass was an unforeseen result of sportfish stockings, and Texas Parks and Wildlife Department (TPWD) currently is combating genetic contamination via supplemental stocking of pure strain, hatchery-produced individuals (Carmichael and Williamson 1986; Garrett 1991; Koppelman and Garrett 2002). Habitat degradation has resulted in localized extirpations and declines in abundance throughout Guadalupe bass range, but specific causes remain poorly understood (Edwards 1978, 1980). Furthermore, despite the longstanding recognition of Guadalupe bass as a stream-adapted species (Hurst et al. 1975), a paucity of data exists pertaining to Guadalupe bass autecology in lotic systems (Garrett 1991).

To date, the ecology, geographic variation, reproduction, diet and mesohabitat associations of Guadalupe bass have been investigated in a single study (i.e., Edwards 1980). Whereas data from Edwards (1980) were relied upon heavily in developing the current management and conservation initiatives for Guadalupe bass (Garrett 1991), microhabitat associations and selection, as well as movement patterns, were not considered by Edwards (1980). A more complete understanding of Guadalupe bass movement patterns and habitat associations will enhance our understanding of why localized extirpations have occurred following habitat degradation, how future land use changes may impact Guadalupe bass habitat, and what microhabitats may be essential for Guadalupe bass life history (*sensu* Orth and Newcomb 2002). The objectives of this study were to (1) determine monthly and diel movement patterns, (2) quantify habitat associations at an ecologically relevant scale, and (3) quantify habitat preference and

suitability for adult Guadalupe bass throughout the primary reproductive period March through June (Edwards 1980).

STUDY AREA

Genetically pure, naturally occurring populations of Guadalupe bass exist in four western tributaries of the Colorado River drainage and the upper portions of the San Antonio River drainage in central Texas (Koppelman and Garret 2002). Specifically, the San Saba River, Pedernales River, Llano River, and Gorman Creek in the Colorado River drainage and the Medina River in the upper San Antonio River drainage remain free of smallmouth bass introductions and large scale habitat alteration (Figure 2.1A). For this study, two sites that are characteristic of streams inhabited by Guadalupe bass were chosen to enhance inferences for streams throughout Guadalupe bass distribution.

The Llano River originates with Edwards-Trinity Aquifer springs emerging and forming the 80 river kilometer (RKM) long North Llano River in Sutton County, and the 89 RKM South Llano River in Edwards County. These branches converge in Kimble County to form the Llano River proper, which continues 161 RKM east through Mason and Llano counties into Lake Lyndon B. Johnson, an impoundment on the Colorado River (Figure 1B). Mean annual discharge at Junction, Texas, just downstream of the North and South Llano rivers confluence, is $7.4 \text{ m}^3 \text{ s}^{-1}$ (USGS Gauge 08150000). Guadalupe bass were radio-tagged along a one kilometer stretch of the South Llano River ($30^\circ 28' 7'' \text{N}$, $99^\circ 47' 07'' \text{W}$). Guadalupe bass movement from the study area was restricted by a low-water crossing at the South Llano River State Park ($30^\circ 27' 0'' \text{N}$, $99^\circ 48' 46'' \text{W}$)

approximately 4 RKM upstream, and a reservoir at the city of Junction, Texas (30°29'21"N, 99°45'35"W) approximately 4 RKM downstream.

The Pedernales River originates in Kimble County, Texas and flows ~170 kilometers northeastward through Gillespie, Blanco, Hays and Travis Counties and empties into Lake Travis, an impoundment on the Colorado River (Figure 1C). The upper reaches of the Pedernales River rise from spring discharges of the Edwards-Trinity Aquifer, producing a mean annual discharge of $3.4 \text{ m}^3 \text{ s}^{-1}$ at Fredericksburg, Texas (USGS Gauge 08152900). Guadalupe bass were radio-tagged throughout a one kilometer stretch of the Pedernales River near Fredericksburg, Texas (30°13'13"N, 98°54'1"W). Guadalupe bass movement from the study area was restricted by a low-water crossing near State Highway 16 crossing (30°12'41"N, 98°56'30"W) approximately 8 RKM upstream, and a low-head dam near Johnson City, Texas (30°17'25"N, 98°23'58"W) approximately 60 RKM downstream.

METHODS

Transmitter Attachment and Tracking

Twelve Guadalupe bass >180 g were collected from each river using electrofishing during December 2007. Radio transmitters (Advanced Telemetry Systems Model F1580) with 250 day battery life were surgically implanted following the anesthetization methods of Peake (1998; 60 mg/L) and surgical methods of VanArnum et al. (2004). To improve retention, tag antennae were inserted through a small puncture made 10 to 15 mm behind the incision using a modified hypodermic needle (Stormer 2007). Fish were released at the site of collection after regaining equilibrium and normal

swimming ability, and a period of seven days was given for fish to adjust to added weight of radio transmitters (i.e., 3.6 g, <2% body weight; Winter 1996) before tracking was conducted January 6, 2008 through August 16, 2008. Three element, handheld directional yagi antennae (Advanced Telemetry Systems) and Lotek Model SRX 400 (150 MHz) radio receivers were used to track Guadalupe bass by walking shoreline in shallow areas and from kayak in deep areas. Triangulation techniques and visual observation from shoreline and by snorkeling (Winter 1996) improved radiolocation accuracy. When radio signals were not detected within a given river, multiple kayak passes were conducted from upstream to downstream boundaries.

Movement and Habitat Associations

Tracking during daylight hours was conducted bi-weekly, roughly every 11 to 16 days, throughout the study (Horton et al. 2004). Diel movement and habitat associations were assessed on a subset of individuals ($n = 5$) in the Pedernales River by conducting hourly tracking for a period of 15 to 24 consecutive hours on three evenly distributed occasions: March, May, July (Todd and Rabeni 1989). Bi-weekly and diel movements were analyzed independently (Horton et al. 2004) as the linear distance moved since the last tracking session (Stromer 2007). Movement patterns of individuals were classified as sedentary (those that remained within the original capture mesohabitat), upstream, and downstream, and maximum distances moved were measured from the original capture site (VanArnum et al. 2004). Upon each relocation, we recorded Global Positioning Satellite (GPS) coordinates (Trimble model XH units with sub-meter accuracy), water

temperature (°C), current velocity (m/s), depth (m), mesohabitat, dominate substrate, and instream cover or distance to cover (Table 2.1).

Habitat Availability

We determined habitat suitability by calculating the proportion of habitat used from tracking observations in ratio to the total available habitat. Traditional transect sampling methods (Simonson et al. 1994) were inadequate for estimating distribution and availability of all cover types (i.e., large woody debris and undercut banks) in our study streams. Thus, we utilized a novel approach to mapping and modeling available habitat over a representative stretch of each river (i.e., 40x mean channel width; Simonson et al. 1994). Trimble model XH units were used to delineate polygons of available cover, mesohabitat and dominate substrates within our study areas. Standard survey equipment was used to measure topography within the annual wetted channel of each study site by using a stratified random sampling design that incorporated all available heterogeneity in topography. Latitude (X), longitude (Y), topography (Z) and dominate substrate (roughness) were recorded in Trimble data dictionaries for each point surveyed. Water surface elevation (WSE) was recorded longitudinally for each river, encompassing changes in WSE at each mesohabitat (i.e., at the upstream and downstream point of each). Survey data (X, Y, Z; roughness) and WSE data were loaded in Multi-Dimensional Surface-Water Modeling System (MDSWMS; McDonald et al. 2001) to model distribution and availability of current velocities and depths following the methods of Barton et al. (2005). Two-dimensional solution files for depths and current velocities were exported from MDSMWS and overlaid with cover, substrate, and mesohabitat

polygons in ArcView 9.2 to yield spatially explicit layers of mapped sections for each river.

Data Analyses

Sample sizes for all statistical analyses were calculated as the number of individuals for which ≥ 12 radiolocations were obtained over the course of the study; individuals with < 12 radiolocations were removed from analyses. Distances moved during bi-weekly and diel tracking were analyzed using ArcView 9.2 (Environmental Systems Research Institute 2007). Mean monthly movement (m/d) was calculated as the grand mean of all individual mean movements within a given month (VanArnum et al. 2004). Mean diel movement (m/h) was calculated in a similar fashion, but mortality of three fish, and subsequent inclusion of three different fish, by July precluded a repeated measures analysis of diel movement across months. As a result, only mean ($\pm$ SD) movement rates are reported for diel movements. To assess associations with movement, factors commonly identified with black bass movement (i.e., water temperature, calendar day number, flow rate and reproductive season; Railsback et al. 1999) were ordinated using principal components analysis (PCA; CONOCO 2002). Magnitude of grand mean movement for each month was included in the PCA biplot to illustrate factors associated with greater magnitudes of Guadalupe bass movement. Bi-weekly habitat observations were ordinated using PCA to assess changes in habitat associations during the study. Grand mean monthly PCA scores were calculated for each river to illustrate changes in habitat associations through time. Observed habitat associations collected during diel tracking were ordinated using PCA and diel times were included in the PCA biplot to

illustrate habitat associations during day and night. For PC analyses, qualitative variables (i.e., reproductive season, cover, mesohabitat, substrate, and river) were represented by dummy variables and quantitative variables (i.e., temperature, day number, flow, distance to cover, depth and velocity) were z-score transformed (Williams and Bonner 2006).

Univariate statistical analyses were used to assess cover, substrate and mesohabitat preference or avoidance as well as habitat suitability for current velocity and depth by considering observed usage versus total available habitats. Total availability of cover types was calculated as the area (m^2) of polygons for each cover type within the mapped region of each river. Total availability of substrate classes was calculated using data collected during stratified random sampling of each river. Total available mesohabitat was calculated as the area (m^2) of polygons for each mesohabitat within the mapped region of each river. For cover, substrate and mesohabitat, the number of observations within a given class were figured for each individual and averaged across individuals to yield mean percent use. Preference or avoidance of cover, substrate and mesohabitat were determined using the electivity index of Jacobs (1974), where 1 indicates complete preference and -1 indicates complete avoidance (Stormer 2007). Habitat suitability was calculated using all observations of Guadalupe bass associations with current velocities and depths, including observations made during diel hours for individuals in the Pedernales River. Bin widths of suitability curves were determined using the Sturges (1926) equation for all available depths and velocities (extracted from MDSWMS) and use versus availability were plotted (Newcomb et al. 2007).

RESULTS

Lengths of radio tagged Guadalupe bass ranged 320 – 480 mm total length (TL) in the South Llano River and 260 – 373 mm TL in the Pedernales River. Twenty-two of the 24 radio tagged Guadalupe bass survived greater than five months for a minimum of 12 relocations per fish and were retained for statistical analysis. Two individuals excluded from analysis were radio tagged in the South Llano River. One shed tag was found downstream in February and the other was not relocated after March. Among the 22 tagged fish, 17 fish survived and five fish died (May $n = 1$, June $n = 2$ and July $n = 2$) by the end of the study period in August 2008. Causes of mortality included angler harvest ($n = 1$), predation by a large flathead catfish *Pylodictis olivaris* ($n = 1$), avian predation ($n = 2$) and undetermined ($n = 1$).

Monthly and Diel Movement

Among the 22 fish, 13 were sedentary (mean $\pm$ SD distance from capture site = 16.6 ± 24.1 m), six moved upstream ($1,026.8 \pm 425.5$), and three moved downstream ($1,539.0 \pm 1641.3$). Five of the upstream movements (max. distance = 1,472 m) occurred in the Pedernales River during June. Only one fish moved upstream 627 m in the South Llano River during April. Three fishes moved downstream (max distance = 3,420 m) in the South Llano River during April.

Mean monthly movements ranged from < 1 m/d to 9 m/d and were primarily associated with reproductive season. The first two principal component axes (PCA) explained 82% of total variation in factors generally associated with black bass movement (Table 2.2). The first PCA (56% of total variation) represented a temperature,

day number, and flow gradient (Figure 2.2). Months with highest negative loadings along PCA I were characterized by higher mean temperatures (loading = -1.29) and greater day number (Julian date; -1.23), whereas months with high positive loadings were characterized by higher mean monthly flow (0.86). The second PCA (26%) primarily represented a reproductive period gradient. Months with highest negative values along PCA II were characterized by reproductive season (-1.89). Fish movement was not associated with PCA I ($r = 0.17$, $P = 0.51$) and positively associated with PCA II ($r = 0.77$, $P < 0.01$), specifically reproductive season. Increases in movement rates were correlated with increases in temperature until maximum movement rates occurred (Jan-Apr, South Llano River $r = 0.98$, $P < 0.01$; Jan- Jun, Pedernales River $r = 0.97$, $P < 0.01$).

Diel movements ranged from 0 to 35 m/h during the day and from 0 to 45 m/h during the night. Mean ($\pm$ SD) movement rate (m/h) during the day was 3.54 ($\pm$ 3.21) in March, 16.30 ($\pm$ 16.35) in May, and 5.28 ($\pm$ 7.57) in July. Mean ($\pm$ SD) movement rate during the night was 6.35 ($\pm$ 9.28) in March, 13.67 ($\pm$ 16.08) in May, and 5.49 ($\pm$ 6.30) in July.

Habitat Associations

The first two PC axes explained 30% of total variation in available habitats within the South Llano River and Pedernales River (Table 2.2). The first PCA (18% of total variation) represented a velocity, depth and substrate gradient (Figure 3). Habitats with high negative loadings along PCA I were characterized by run mesohabitats (-1.57) with swift current velocity (-1.52) over coarse gravel substrate (-1.11). Habitats with high positive loadings along PCA I were characterized by pool mesohabitats (1.86) with silt

substrate (1.66) and greater depths (1.47). The second PCA (12%) represented primarily a cover gradient. Habitats with high negative loadings along PCA II were characterized by greater distances from cover (-1.65) and great depths (-1.01) over cobble substrate (-0.82). Habitats with high positive loadings along PCA II were characterized by instream cover (2.21) over bedrock substrate (1.48) in backwater mesohabitats (1.40). Among available habitats, Guadalupe bass were relocated among several mesohabitat types, depths, current velocities, and substrates (Figure 2.3A). Grand mean (i.e., all fish combined) PCA scores of habitat associations were near the origin of PCA I, split between run and pool mesohabitats in the South Llano River (mean $\pm$ SD = -0.06 ± 0.248) and positive, towards pool mesohabitats in the Pedernales River (0.19 ± 0.306 ; Figure 3B). Grand mean PCA scores of habitat associations were positively associated (0.16 ± 0.186 South Llano River; 0.19 ± 0.263 Pedernales River) with PCA II, towards instream cover. Plotting trajectory of mean PCA scores by month and across individual fish, associations with cover and bedrock substrates were stronger in the winter (pre-reproductive season) in both rivers, thereafter associations were with greater distances from cover and greater depths (Figure 2.3C). With the onset of the reproductive season (March through June), trajectories moved negatively along PCA I for the South Llano River and positively along PCA I for the Pedernales River. Contrasting shifts along PCA I generally corresponded with declining flows in the Pedernales River (Figure 2.4).

For diel habitat associations, the first two PCA axes explained 38% of total variation in available habitats in the Pedernales River (Table 2.2). The first PCA axis (22% of total variation) represented a mesohabitat, velocity and cover gradient. Mean PCA scores with high negative loadings for PCA I were characterized by silt substrate (-

1.63) and instream cover (-1.25) in pool mesohabitats (-1.09; Figure 2.5). Mean PCA scores with high positive loadings for PCA I were characterized by higher current velocities (1.76) in run mesohabitats (1.51) with cobble substrate (1.41). The second PCA axis (16%) represented a mesohabitat, cover and depth gradient. Mean PCA scores with high negative loadings for PCA II were characterized by instream cover (-1.62) in backwater mesohabitats (-1.58) over bedrock substrate (-0.97). Mean PCA scores with high positive loadings for PCA II were characterized by pool mesohabitats (1.80) with greater distances from cover (1.79) and greater depths (1.50). Diurnal and nocturnal observations of individuals were generally split along a diagonal gradient from positive PCA I to positive PCA II. Diurnal observations were generally negative along PCA I and II, and were characterized by instream cover in backwaters or pools over silt or bedrock. Nocturnal observations were generally positive along PCA I and II, and were characterized by either pool mesohabitats with greater depths or run mesohabitats with greater velocities, but overall distances from cover were greatest during nocturnal hours. Nocturnal associations with run mesohabitats dominated observations in March, but a gradual shift toward pool mesohabitats occurred in May and July.

Guadalupe bass habitat use varied in comparison to availability among univariate gradients. Open water constituted > 90% of available habitat in both rivers, but mean percent use across fish indicated open water was avoided (Jacobs electivity < -0.9 for both rivers; Figure 2.6). Jacobs electivity values were > 0.7 for all instream cover types except vegetation, which was the least available cover in the Pedernales River (< 0.1%) and was not used, resulting in a Jacob's electivity value of -1. Electivity values were positive for silt, sand, fine gravel and course gravel in the South Llano River, and silt,

course gravel and bedrock in the Pedernales River (Figure 2.7). Electivity values were positive for backwater and eddy in the South Llano River, and pool, backwater, and eddy in the Pedernales River. Available depths ranged 0 – 6 m, and suitability was highest (1.0) for 1.0 m depth in both rivers, and use was correlated with availability for depths > 1.0 m (South Llano River $r = 0.90$, $P < 0.01$; Pedernales River $r = 0.88$, $P < 0.01$; Figure 2.8). Available velocities ranged 0 – 0.6 m/s, and suitability was highest (1.0) for 0.05 m/s in both rivers, and use was correlated with availability for velocities > 0.05 m/s (South Llano River $r = 0.91$, $P < 0.01$; Pedernales River $r = 0.97$, $P < 0.01$), although observed values of velocity were consistently less than available in the South Llano River.

DISCUSSION

Guadalupe bass were associated with eddy mesohabitats created by instream cover within or adjacent to run mesohabitats, small to medium size substrates, 1.0 m depths, and <0.1 m/s current velocities. Log complexes, boulders, and ledges were used often, whereas open water generally was avoided. Microhabitats used by Guadalupe bass in this study are similar to those reported for other stream-dwelling *Micropterus*. Smallmouth bass in rivers are associated with large woody debris and boulders, depths ranging from 1 to 2 m, current velocities <0.2 m/s, and avoid open water during daylight hours (Todd and Rabeni 1989; Orth and Newcomb 2002). Spotted bass and shoal bass are associated with eddy mesohabitats, depths ranging 0.4 – 1.4 m, current velocities < 0.35 m/s, and preferred boulder cover types while avoiding open water (Horton and Guy 2002; Stormer 2007).

Movement patterns of Guadalupe bass during eight months of tracking ranged from within mesohabitat to 3.4 km from point of initial capture. Among 22 fish, 13 bass moved < 58 m and remained within mesohabitats of initial capture, whereas nine bass moved into other mesohabitats with similar microhabitats. *Micropterus* in streams and rivers are primarily sedentary (movement < 1.6 km; Funk 1957), but more mobile individuals of largemouth bass and smallmouth bass travel up to 24 km (Funk 1957; Raibley et al. 1997; Lyons and Kanehl 2002; VanArnum et al. 2004). Intraspecific variation in movement is known for several riverine-type fishes (Funk 1957; Gerking 1959; Hill and Grossman 1987; Gatz and Adams 1994; Smithson and Johnston 1999) and likely attributed to biotic (i.e., genetics, ontology, population size) and abiotic (i.e., habitat availability and suitability, spates, drying) conditions (Funk 1957; Raibley et al. 1997; VanArnum et al. 2004; Stormer 2007; Remshardt and Fisher 2008; Cooke et al. 2008).

Habitat associations and movement patterns of Guadalupe bass were influenced by season. During winter, habitat associations were narrow and movement rates ranged < 1 – 3 m/d. During spring and the reproductive season, habitat associations were broader and movement rates ranged 3 – 9 m/d. During late summer, habitat associations were narrow and movement rates ranged < 1 – 3 m/d. Inhabiting undercut banks or instream covers requires minimal energy expenditure for abiotic (e.g., current velocity) or biotic (e.g., vigilance) conditions during the winter at a time with low prey availability (Edwards 1980; Raibley et al. 1997; Allouche 2002). Daily movements from winter into spring typically increase > 200% in *Micropterus* and are related to foraging activities and reproduction (Edwards 1980; Mesing and Wicker 1986; Todd and Rabeni 1989; Horton

and Guy 2002; Stormer 2007). Consequently, habitat associations are more general and home range sizes increase during the spring (Todd and Rabeni 1989; Raibley et al. 1997). Regardless, Guadalupe bass, like many other stream-dwelling fishes (Schlosser and Angermeier 1995), were not involved in long-range spawning migrations.

Additional environmental factors related to Guadalupe bass movement, and consequently habitat associations, were time of day and flow regime. Guadalupe bass often shifted from within cover habitats during the day to open water during the night. Associating with cover during the day likely reduces predation risks for the Guadalupe bass (Horton and Guy 2002), and movement into open water is likely for nocturnal foraging (Todd and Rabeni 1989). In addition to diel movements, Guadalupe bass were readily responsive to changes in the flow regime. During the May 2008 diel tracking period, Guadalupe bass in the Pedernales River shifted from branches and roots along the stream bank to downstream of boulders or bedrock ledges during a rapid rise in flows caused by a flash flood event. Use of instream structure as refugia is suspected in stream-adapted fishes (Minckley and Meeffe 1987) to resist downstream displacement. To date, telemetry studies only tracked smallmouth bass to eddy mesohabitats with lower current velocities during a flood event (Todd and Rabeni 1989). Also in the Pedernales River, Guadalupe bass gradually shifted towards pools with greater depths during a period of extreme low flow in summer. Fish responding to periods of stream drying by moving from preferred habitats is common in stream fishes (Matthews 1996) and *Micropterus* (Stormer 2007).

Habitat degradation is the most significant threat to Guadalupe bass persistence (Edwards 1980). Herein, Guadalupe bass habitat for individuals >260 mm in TL

consisted of a heterogeneous mix of run and open water pool habitats with undercut banks and instream woody debris. Extirpation of the Guadalupe bass in the Concho River of Texas (Edwards 1980) is likely attributed to changes in available habitats because of dam construction, in which flood pulses, undercut banks, habitat heterogeneity, and deposition of large woody debris are typically reduced (Poff et al. 1997; Crook and Robertson 1999). Similar habitat changes attributed to dam construction and mismanagement of watersheds likely caused population declines and localized extirpations in shoal bass (Stormer 2007). Future concerns for Guadalupe bass persistence include stream dewatering (Hurst et al. 1975) and aquifer drawdown (Bowles and Arsuffi 1993) as well as localized extirpations following impoundment (Edwards 1978) and competition with lacustrine-adapted species (Koppelman and Garrett 2002), all of which may contribute to reduction of Guadalupe bass range (Jelks et al. 2008). Such negative impacts associated with anthropogenic stream alteration occur worldwide and may be mitigated by watershed management practices that favor sustainable management and ecological integrity (Richter et al. 2003).

Table 2.1: Habitat parameters measured or modeled for Guadalupe bass in the South Llano River and Pedernales River.

Parameter	Description
Temperature	Water temperature measured in °C
Velocity	Current velocity measured in m/s
Depth	Maximum depth measured in m
Mesohabitat ¹	
Run	Moderate depth, moderate to swift current and dominated by bedrock or boulder substrate
Riffle	Shallow depth, moderate to swift current and dominated by gravel or cobble substrate
Pool	Greater depth, little to no current and dominated by silt or sand substrate
Eddy	Moderate depth, circular flow near run or riffle
Backwater	Moderate to shallow depth, little current and within instream cover
Substrate ²	
Bedrock	Unbroken stream bottom
Silt	Small particles less than 0.6 mm
Sand	Diameter between 0.6 and 2mm
Small Gravel	Diameter between 2 and 16 mm
Course Gravel	Diameter between 16 and 64 mm
Cobble	Diameter between 64 and 256 mm
Boulder	Diameter between 256 and 4096 mm
Instream Cover ³	
Log	A single log with large diameter
Log Complex	Two or more logs forming a single structure
Branches	Submerged branches or branches extending into the water
Vegetation	Submerged or emergent aquatic vegetation
Roots	Roots of deposited large woody debris or associated with bank overhang
Undercut Bank	Eroding or over hanging banks (without roots present)
Boulder/Ledge	Crevice of large boulders and ledges formed by bedrock outcroppings
Open Water	Water >0.33 m deep with no cover immediately adjacent
Distance to Cover	Linear distance to nearest cover measured in m

¹Stormer (2007), ²Modified Wentworth (McMahon et al. 1996), ³Snedden et al. (1999)

Table 2.2: Loadings and eigenvalues for parameters on principal components axes (PCA) I and II included in three PCA models (Movement, Monthly Habitat and Diel Habitat) for Guadalupe bass tracked in the South Llano River and Pedernales River January through August 2008. Bolded values are illustrated in PCA biplots (Figures 2, 3, and 5).

Model Parameter	Movement		Monthly Habitat		Diel Habitat	
	PCA I	PCA II	PCA I	PCA II	PCA I	PCA II
Temperature	-1.2973	-0.2141	-	-	-	-
Day Number	-1.2262	0.2765	-	-	-	-
Flow	0.8606	-0.5239	-	-	-	-
Reproductive Season	-0.2698	-1.8982	-	-	-	-
Cover	-	-	0.4017	2.202	-1.2489	-1.6188
Distance	-	-	0.1921	-1.6458	0.4886	1.7892
Velocity	-	-	-1.5221	-0.2776	1.7605	-0.2225
Depth	-	-	1.4714	-1.0064	-0.8171	1.5026
Eddy	-	-	-0.1055	1.2452	-0.1587	-0.0164
Backwater	-	-	0.4722	1.3946	-1.0615	-1.5765
Pool	-	-	1.8568	-0.7673	-1.0868	1.7994
Run	-	-	-1.5715	-0.7464	1.5148	-0.2711
Riffle	-	-	-0.6091	-0.356	0.8499	-0.0391
Bedrock	-	-	0.3035	1.4822	-0.0811	-0.9656
Boulder	-	-	0.0152	0.0603	-0.1187	-0.4859
Cobble	-	-	-0.897	-0.8189	1.4114	0.0442
Course Gravel	-	-	-1.1057	0.453	0.5545	0.0028
Fine Gravel	-	-	-0.1748	-0.2104	0.3203	0.1062
Sand	-	-	0.4778	-0.2412	-0.0813	0.8342
Silt	-	-	1.6635	-0.5344	-1.6294	0.4412
River	-	-	0.8074	0.3475	-	-
Eigenvalue	0.56	0.26	0.18	0.12	0.22	0.16

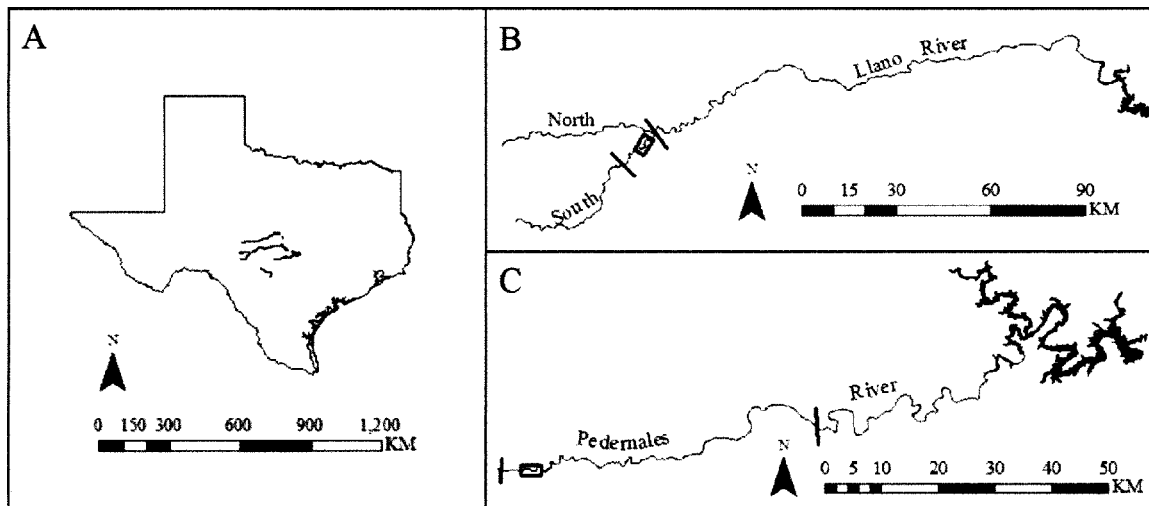


Figure 2.1: (A) Current distribution of naturally occurring, genetically pure Guadalupe bass populations, streams are (North to South): San Saba River, Gorman Creek, Llano River, Pedernales River, and Medina River (Koppelman and Garrett 2002); (B) Study site (indicated by rectangle) and physical barriers (solid lines) on the South Llano River; (C) Study site and physical boundaries for Pedernales River; see text for descriptions of physical barriers.

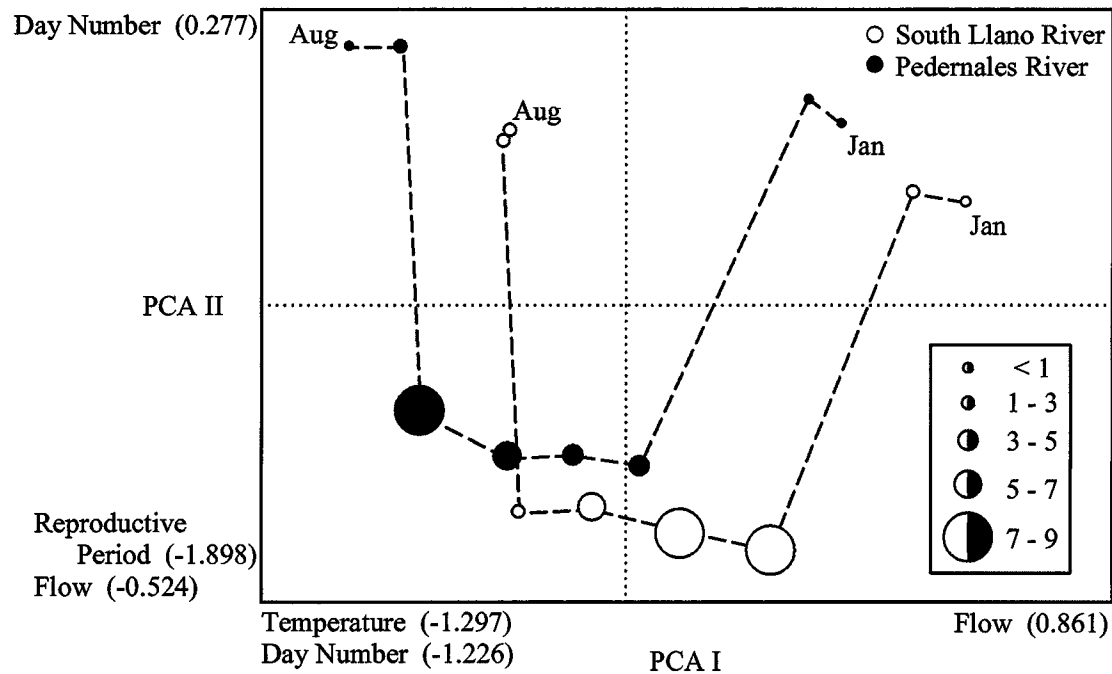


Figure 2.2: Biplot of principal component axes (PCA) I and II for factors associated with mean monthly movement (m/d) of Guadalupe bass in the South Llano River (open circles; $n = 10$) and Pedernales River (closed circles; $n = 12$) January through August 2008. Diameter of circles corresponds with monthly movement rates (m/d) shown in legend. Numbers in parentheses indicate loadings for each parameter.

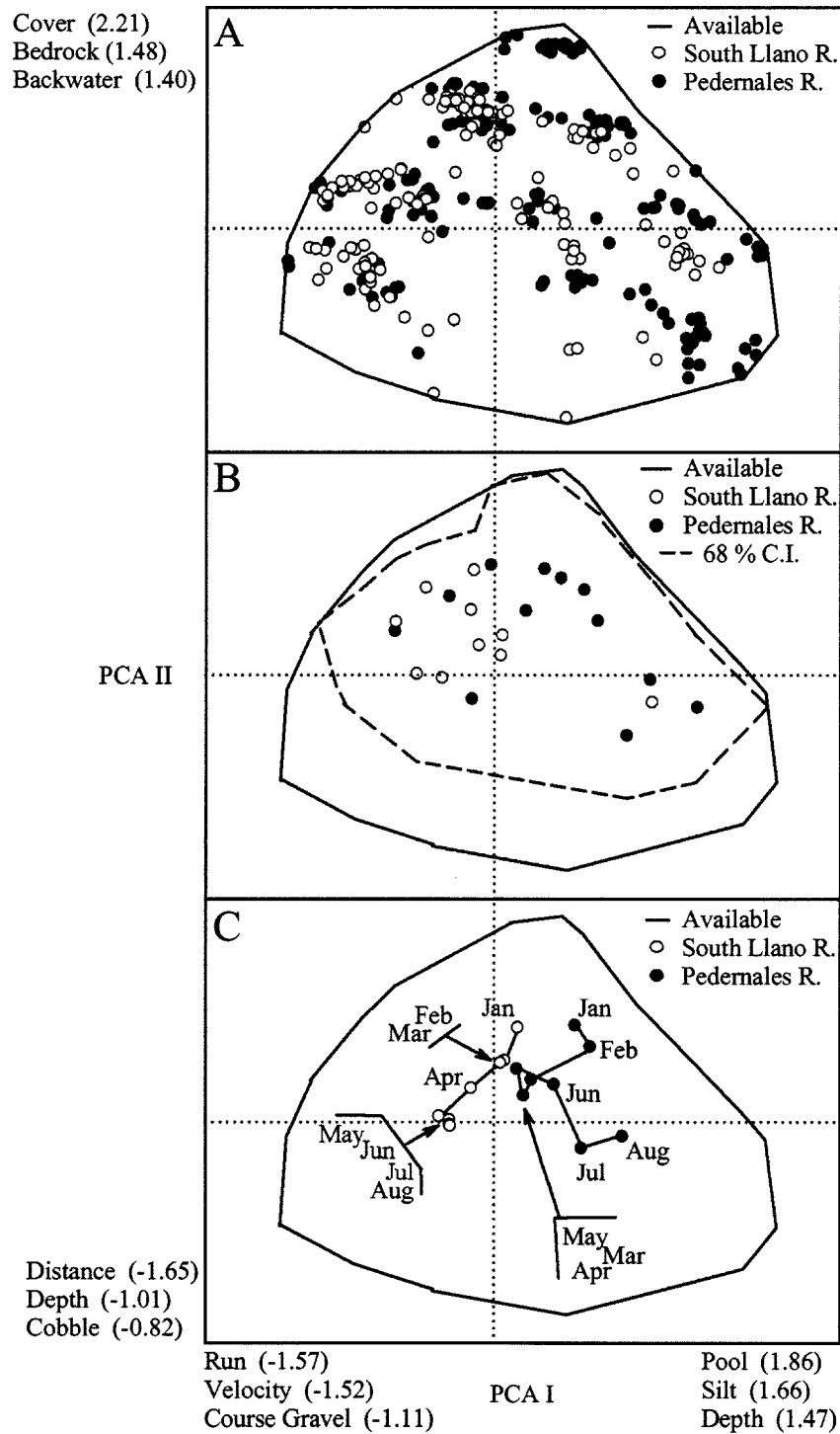


Figure 2.3: Biplots of principal component axes (PCA) I and II for: (A) all available habitat (solid line) and all observations in the South Llano River (open circles) and Pedernales River (closed circles); (B) mean PCA scores per individual (circles) and 68% confidence interval (dashed line) of locations; (C) monthly mean (grand mean of all individuals) PCA scores for 22 Guadalupe bass tracked January to August 2008. Numbers in parentheses indicate loadings for each parameter.

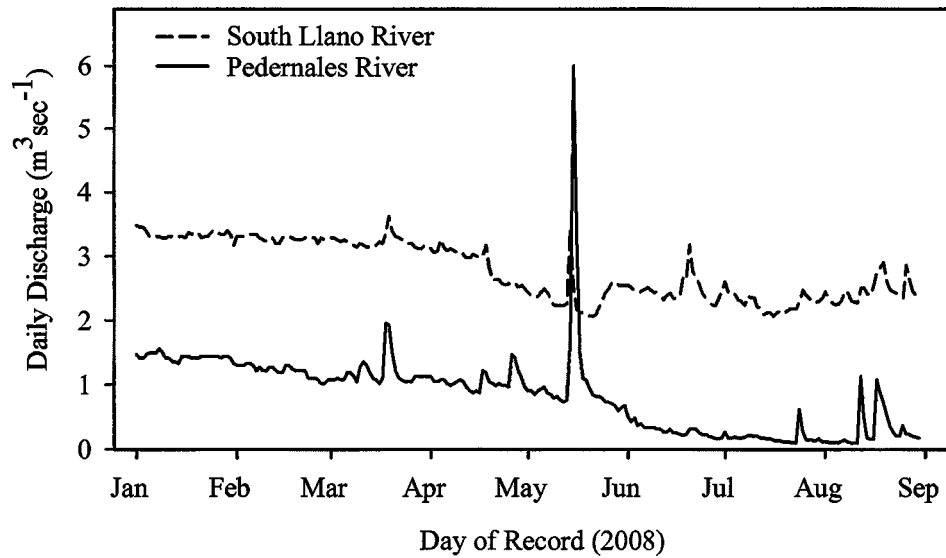


Figure 2.4: Daily discharges for the Pedernales River near Fredericksburg, TX (USGS Gauge I.D. 08152900) and South Llano River near Junction, TX (USGS Gauge I.D. 08150000 – 08148500). Daily discharges for the South Llano River were inferred from North Llano River (USGS 08148500) and Llano River proper (USGS 08150000) discharges measured at Junction, TX.

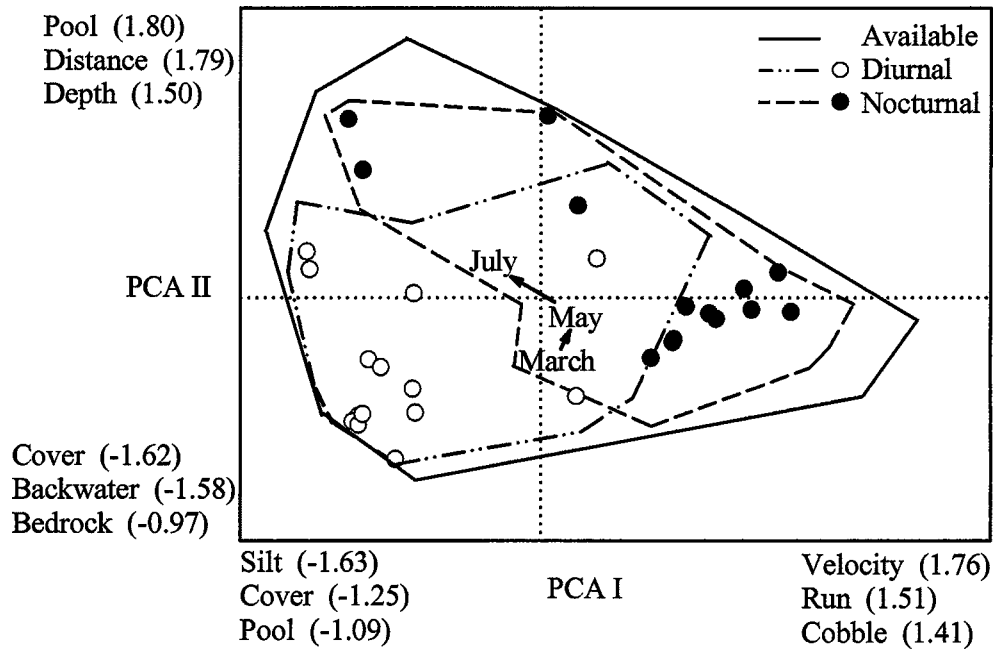


Figure 2.5: Biplot of principal component axes (PCA) I and II illustrating all available habitat (solid line), mean PCA scores and 68% confidence interval of individuals observed during daylight (diurnal; open circles, dash-dot-dot line) and nighttime (nocturnal; closed circles, dashed line) hours in the Pedernales River near Fredericksburg, TX during March, May, and July 2008. “March”, “May”, and “July” indicate mean PCA scores of all individuals tracked for that month (includes diurnal and nocturnal). Numbers in parentheses indicate loadings for each parameter.

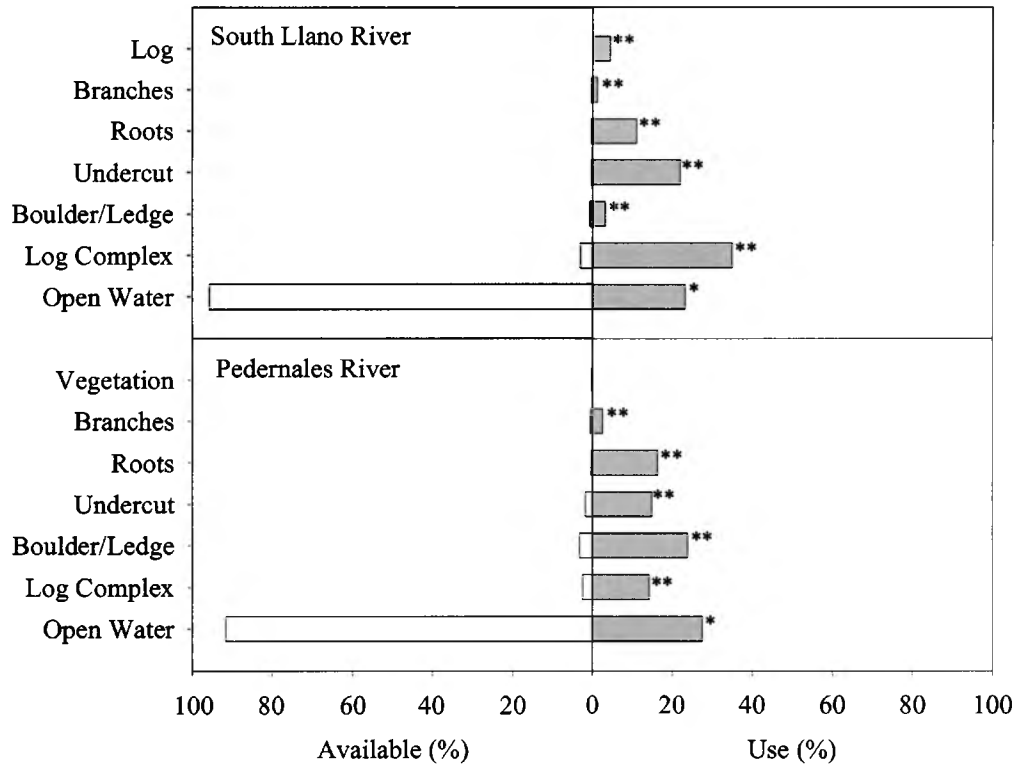


Figure 2.6: Percent frequency occurrence of available habitat (white bars) and mean percent use (grey bars) in the South Llano River and Pedernales River for 22 Guadalupe bass tracked January through August 2008. One asterisk indicates avoidance: Jacob's electivity value < -0.9 ; two asterisks indicate preference: Jacob's electivity value > 0.7 .

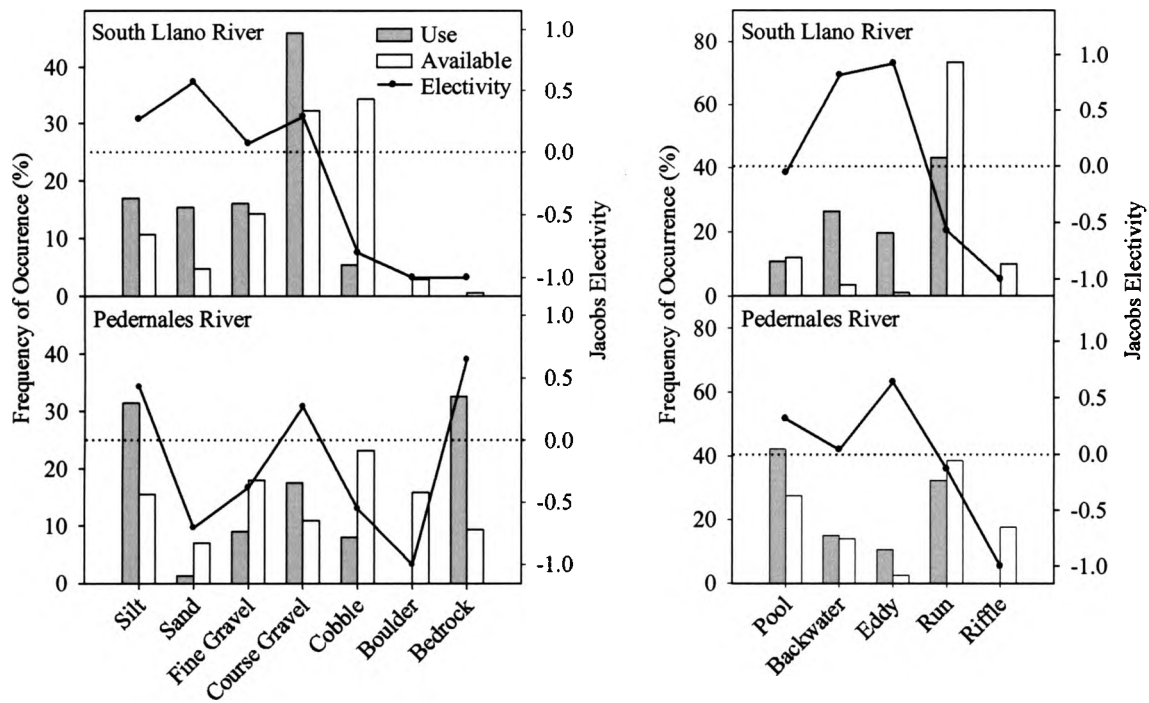


Figure 2.7: Mean percent use (grey bars), frequency occurrence of availability (white bars), and Jacobs (1974) electivity values (circles, solid line) for substrates and mesohabitats used by Guadalupe bass in the South Llano River and Pedernales River January through August 2008. Positive electivity values indicate preference and negative electivity values indicated avoidance.

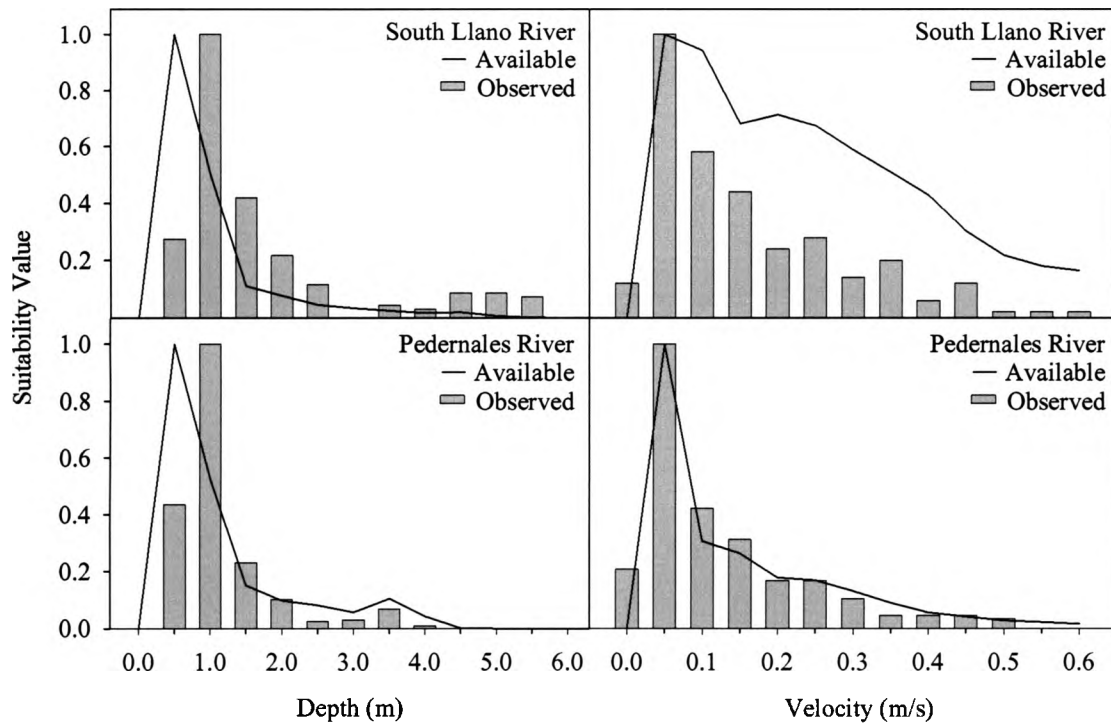


Figure 2.8: Suitability curves for observed habitat use (grey bars) and available habitat (solid line) in terms of depth (m) and velocity (m/s) for Guadalupe bass in the South Llano River ($n = 162$ observations) and Pedernales River ($n = 393$) between January and August 2008.

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APPENDIX I
HISTORICAL FISH COLLECTIONS FROM THE UPPER GUADALUPE RIVER

	Date:	6/23/1938	6/30/1938	6/25/1939	7/20/1939 ^a	7/27/1939 ^a	7/31/1939	8/20/1939 ^a
	Collector:	Hubbs and Family	Norris	Norris	Bonham and Class	Bonham and Class	Bonham	Bonham and Class
	Locality:	Near source, at Hunt	At Ingram	At Kerrville	Methodist Camp at Kerrville	Pool below Cherry Creek Crossing	One mile above Ingram	Sunnybank Camp
	Source:	UMMZ	UMMZ	UMMZ	TCWC	TCWC	TCWC	TCWC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	16	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		2	19	11	182	-	-	-
<i>Cyprinella lutrensis</i>		2	4	70	-	15	9	-
<i>Cyprinella lutrensis X venus</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	1	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		3	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	8	27	217	-	36	-
<i>Notropis stramineus</i>		-	-	17	25	-	-	-
<i>Notropis volucellus</i>		-	-	5	-	-	-	4
<i>Notropis sp</i>		-	-	21	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpodes carpio</i>		-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>		-	-	-	-	-	-	-
<i>Mniytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	41	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		2	-	-	-	-	-	-
<i>Ictalurus lupus</i>		8	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Pygocentrus nattereri</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		83	30	76	-	-	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-

Date:	6/23/1938	6/30/1938	6/25/1939	7/20/1939^a	7/27/1939^a	7/31/1939	8/20/1939^a
Collector:	Hubbs and Family	Norris	Norris	Bonham and Class	Bonham and Class	Bonham	Bonham and Class
Locality:	Near source, at Hunt	At Ingram	At Kerrville	Methodist Camp at Kerrville	Pool below Cherry Creek Crossing	One mile above Ingram	Sunnybank Camp
Source:	UMMZ	UMMZ	UMMZ	TCWC	TCWC	TCWC	TCWC
<i>Lepomis auritus</i>	-	-	-	-	-	-	4
<i>Lepomis cyanellus</i>	5	-	-	-	-	-	7
<i>Lepomis cyanellus X macro</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	10	-
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis megalotis</i>	23	-	-	-	-	30	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	7	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	10	5	-
<i>Micropterus sp X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	3	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	8	2	-	-	-	-	-
<i>Etheostoma spectabile</i>	1	-	3	-	-	-	-
<i>Percina carbonaria</i>	1	-	-	-	-	1	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	1
Total	148	64	230	440	66	91	16

^aCollection not used in analyses

Date:	10/20/1939	12/16/1939	2/17/1940 ^a	3/22/1950	11/26/1950	7/4/1951 ^a	7/5/1951 ^a
Collector:	Bonham and Class	Bonham and Party	Bonham and Party	Jurgens and Brown	Knapp and Class	Hubbs et al	Hubbs and Class
Locality:	Johnson's fork at Fessenden Ranch	Camp Waltonia b/t Ingram and Hunt	At Hunt, below crossing to Camp Waltonia	Low-water bridge at Hunt	At Hwy 281 crossing	One mile W of Ingram	Three miles W of Ingram
Source:	TCWC	UMMZ	TCWC	TNHC	TCWC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	1	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>	-	-	5	45	-	-	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	45	-	-	-	-	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	10	-	-	-
<i>Notropis amabilis</i>	-	34	-	1	-	2	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	30	-	21	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	11	22	-	-
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erismyzon sucetta</i>	1	-	-	-	-	-	-
<i>Mniotremis melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	1	7	-	1	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	-
<i>Pylodictus olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	-	-	37	23	-	-
<i>Poecilia latipinna</i>	-	-	-	5	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

	Date:	10/20/1939	12/16/1939	2/17/1940^a	3/22/1950	11/26/1950	7/4/1951^a	7/5/1951^a
	Collector:	Bonham and Class	Bonham and Party	Bonham and Party	Jurgens and Brown	Knapp and Class	Hubbs et al.	Hubbs and Class
	Locality:	Johnson's fork at Fessenden Ranch	Camp Waltonia b/t Ingram and Hunt	At Hunt, below crossing to Camp Waltonia	Low-water bridge at Hunt	At Hwy 281 crossing	One mile W of Ingram	Three miles W of Ingram
	Source:	TCWC	UMMZ	TCWC	TNHC	TCWC	TNHC	TNHC
<i>Lepomis auritus</i>		-	-	-	-	-	-	3
<i>Lepomis cyanellus</i>		-	-	-	1	-	-	-
<i>Lepomis cyanellus X macrochirus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	1	-	-	-
<i>Lepomis macrochirus</i>		-	-	-	1	-	-	-
<i>Lepomis megalotis</i>		-	10	-	12	-	-	-
<i>Lepomis microlophus</i>		-	-	-	1	-	1	-
<i>Lepomis miniatus</i>		-	-	-	-	-	3	5
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	-
<i>Micropterus sp X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	2	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		3	5	-	-	-	4	5
<i>Etheostoma spectabile</i>		-	-	1	-	2	19	7
<i>Percina carbonaria</i>		2	-	-	-	1	-	-
<i>Percina apristis</i>		-	-	-	1	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	1	1	-	2
Total		52	80	13	150	50	29	22

^aCollection not used in analyses

Date:	7/15/1951	7/17/1951 ^a	7/21/1951	7/24/1951	7/25/1951	7/25/1951	7/26/1951
Collector:	Hubbs	Hubbs and Class	Hubbs	Hubbs	Hubbs and Gilstrap	Hubbs and Gilstrap	Hubbs
Locality:	6.5 miles SW of Camp Mystic crossing	Bridge at Center Point	1.5 miles S of Sisterdale	Five miles E of Center Point	4.5 miles N of Bergheim	1.5 miles SE of Spring Branch	3.5 miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	1	-	-	-	-	1
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>	-	14	34	54	62	31	36
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	8	-	5	-	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	12	9	15	11
<i>Notropis anabilis</i>	-	-	21	-	31	-	38
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	-	24	17	9	4	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	13	-	-	-
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	3	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	12	-	-	-	-	8	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	4
<i>Gambusia affinis</i>	46	-	-	3	17	12	27
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	7/15/1951	7/17/1951^a	7/21/1951	7/24/1951	7/25/1951	7/25/1951	7/26/1951
Collector:	Hubbs	Hubbs and Class	Hubbs	Hubbs	Hubbs and Gilstrap	Hubbs and Gilstrap	Hubbs
Locality:	6.5 miles SW of Camp Mystic crossing	Bridge at Center Point	1.5 miles S of Sisterdale	Five miles E of Center Point	4.5 miles N of Bergheim	1.5 miles SE of Spring Branch	3.5 miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	2	-	-	-	-	-
<i>Lepomis cyanellus</i>	21	-	4	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	10	-	-	-	-	-	4
<i>Lepomis megalotis</i>	8	2	7	6	15	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	10	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	16	4	-	-	-	-	-
<i>Micropterus sp. X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	-	13	18	-	10
<i>Percina carbonaria</i>	-	-	-	10	3	12	3
<i>Percina apristis</i>	-	-	-	-	-	-	7
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	-
Total	123	34	90	133	164	82	141

^aCollection not used in analyses

Date:	7/28/1951	8/1/1951	8/1/1951	8/4/1951	8/6/1951	8/9/1951	8/10/1951
Collector:	Hubbs	Hubs	Hubbs and Gilstrap	Hubbs and Hubbs	Hubbs	Hubbs	Hubbs et al
Locality:	7 miles E of Center Point	At Comfort, mouth of Cypress Creek	0.5 miles N of Waring	2 miles N of Kreutzberg 8 miles NNE of Boerne	At Flat Rock, 4 miles SE of Kerrville	1.75 miles E of Center Point	Two miles WNW of Kerrville
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	1
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	-	-	-	-	10	-
<i>Cyprinella lutrensis</i>	61	26	29	18	17	11	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	13	6	-	-	12	-	16
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	24	13	-	-	9	-
<i>Notropis amabilis</i>	-	-	-	27	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	5	8	7	-	13	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	8	-
<i>Carpiodes carpio</i>	-	-	-	-	-	-	-
<i>Ermyzon suetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	1	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	6	-	12	-	33	14	-
<i>Pylodictis olivaris</i>	4	3	6	5	-	-	-
<i>Gambusia affinis</i>	5	-	-	-	20	-	9
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	7/28/1951	8/1/1951	8/1/1951	8/4/1951	8/6/1951	8/9/1951	8/10/1951
Collector:	Hubbs	Hubs	Hubbs and Gilstrap	Hubbs and Hubbs	Hubbs	Hubbs	Hubbs et al.
Locality:	7 miles E of Center Point	At Comfort, mouth of Cypress Creek	0.5 miles N of Waring	2 miles N of Kreutzberg 8 miles NNE of Boerne	At Flat Rock, 4 miles SE of Kerrville	1 75 miles E of Center Point	Two miles WNW of Kerrville
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	4	2	7	-	2	5	-
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	1	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis megalotis</i>	10	-	12	-	-	1	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	6
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	7
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	6	5	-	3	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	1	-	-	-	-	-
<i>Etheostoma spectabile</i>	10	13	-	10	24	23	22
<i>Percina carbonaria</i>	12	9	11	-	-	-	-
<i>Percina apristis</i>	-	4	-	14	-	7	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	6	-	-	-
Total	131	98	98	90	109	102	61

^aCollection not used in analyses

Date:	8/13/1951 ^a	6/15/1953	6/16/1953	6/16/1953	7/16/1953	11/28/1953 ^a	11/28/1953
Collector:	Hubbs and Boyle	Hubbs and Strawn	Hubbs	Hubbs and Strawn	Hubbs	Hubbs	Hubbs
Locality:	3 75 miles WNW of Kerrville	Two miles W of Ingram	0 25 miles W of Center Point	Two miles NW of Kerrville	At Comfort	At Comfort	Two miles W of Ingram
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	9	1	-	-	-	19
<i>Cyprinella lutrensis</i>	-	1	115	-	189	6	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	15	-	-	31	2	12
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	10	-	3	-	-
<i>Notropis amabilis</i>	-	9	1	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	1
<i>Notropis volucellus</i>	-	-	-	1	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	1	-	-	1
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erismyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	1	-	1	1	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	1	5	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	3
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	44	51	3	-	-	3
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	8/13/1951^a	6/15/1953	6/16/1953	6/16/1953	7/16/1953	11/28/1953^a	11/28/1953
Collector:	Hubbs and Boyle	Hubbs and Strawn	Hubbs	Hubbs and Strawn	Hubbs	Hubbs	Hubbs
Locality:	3.75 miles WNW of Kerrville	Two miles W of Ingram	0.25 miles W of Center Point	Two miles NW of Kerrville	At Comfort	At Comfort	Two miles W of Ingram
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	4	5	3	-	2	1
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	1	1	2	-	-	-	-
<i>Lepomis megalotis</i>	-	1	-	-	-	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	2
<i>Lepomis miniatus</i>	-	7	-	-	2	-	3
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	1	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	1	1	3	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	3	-	-	45	-	-	-
<i>Etheostoma spectabile</i>	21	10	4	-	-	2	6
<i>Percina carbonaria</i>	-	-	-	4	-	10	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	1
Total	26	106	190	58	228	26	52

^aCollection not used in analyses

Date:	11/28/1953	11/28/1953	11/28/1953	11/28/1953	1/8/1954 ^a	4/28/1954	4/28/1954
Collector:	Hubbs and Strawn	Hubbs and Strawn	Hubbs	Hubbs	Hubbs and Strawn	Hubbs and Strawn	Hubbs and Strawn
Locality:	Three miles E of Ingram	Five miles E of Center Point	At Center Point	Three miles E of Comfort	Two miles W of Ingram	Two miles W of Ingram	Three miles E of Ingram
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	3	2	5	2	5	-
<i>Cyprinella lutrensis</i>	-	66	17	11	-	3	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	4	-
<i>Cyprinella venusta</i>	150	-	45	2	16	23	17
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	1	2	-	2	-	-	-
<i>Notropis amabilis</i>	1	1	-	-	-	-	1
<i>Notropis stramineus</i>	4	-	7	-	-	-	4
<i>Notropis volucellus</i>	14	42	-	-	-	-	2
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	5	19	-	-	-	-	6
<i>Carpiodes carpio</i>	-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	2	-	-	-	-	1	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	2	1	-	1	3	-	3
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	11/28/1953	11/28/1953	11/28/1953	11/28/1953	1/8/1954 ^a	4/28/1954	4/28/1954
Collector:	Hubbs and Strawn	Hubbs and Strawn	Hubbs	Hubbs	Hubbs and Strawn	Hubbs and Strawn	Hubbs and Strawn
Locality:	Three miles E of Ingram	Five miles E of Center Point	At Center Point	Three miles E of Comfort	Two miles W of Ingram	Two miles W of Ingram	Three miles E of Ingram
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	1	-	-	-	-	1
<i>Lepomis cyanellus</i>	-	-	-	-	-	2	1
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	1	-
<i>Lepomis macrochirus</i>	-	-	-	-	2	1	-
<i>Lepomis megalotis</i>	2	-	-	-	-	1	4
<i>Lepomis microlophus</i>	3	-	-	-	-	-	1
<i>Lepomis miniatus</i>	1	-	-	-	-	2	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	1	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	5	-
<i>Etheostoma spectabile</i>	32	24	2	83	-	26	23
<i>Percina carbonaria</i>	-	1	1	3	-	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	1	-	-
Total	217	160	74	108	24	74	63

^aCollection not used in analyses

Date:	4/28/1954	7/14/1954 ^a	7/14/1954	10/2/1954	10/2/1954	10/2/1954	10/2/1954
Collector:	Hubbs and Strawn	Hubbs and Springer	Hubbs and Springer	Hubbs	Hubbs	Hubbs and Fosberg	Hubbs
Locality:	At Kerrville	Three miles E of Comfort	At Center Point	Three miles E of Kerrville	Four miles E of Ingram	Five miles E of Center Point	At Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	-	1	3	-	3	-
<i>Cyprinella lutrensis</i>	56	38	49	28	-	24	25
<i>Cyprinella lutrensis X venus</i>	17	-	-	-	-	66	-
<i>Cyprinella venusta</i>	151	9	76	150	97	19	97
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	5	-	-	-	-	2	-
<i>Notropis amabilis</i>	8	-	2	-	3	1	3
<i>Notropis stramineus</i>	74	-	-	-	1	-	-
<i>Notropis volucellus</i>	38	-	-	-	-	19	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	134	-	1	-	-	18	-
<i>Carpodes carpio</i>	-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniotremis melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	2	-	-	5	3	9	2
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	4/28/1954	7/14/1954^a	7/14/1954	10/2/1954	10/2/1954	10/2/1954	10/2/1954
Collector:	Hubbs and Strawn	Hubbs and Springer	Hubbs and Springer	Hubbs	Hubbs	Hubbs and Fosberg	Hubbs
Locality:	At Kerrville	Three miles E of Comfort	At Center Point	Three miles E of Kerrville	Four miles E of Ingram	Five miles E of Center Point	At Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	11	-	-	-	-	-	-
<i>Lepomis megalotis</i>	2	-	-	-	-	3	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	-
<i>Micropterus sp X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	1	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	27	-	-	41	12	42	1
<i>Percina carbonaria</i>	-	24	-	1	-	5	1
<i>Percina apristis</i>	-	2	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	3	-	-	-
Total	526	73	129	231	116	211	129

^aCollection not used in analyses

Date:	10/2/1954	10/2/1954	11/7/1954	11/7/1954	11/28/1954	12/5/1954^a	12/5/1954
Collector:	Hubbs	Hubbs	Hubbs and Fosberg	Hubbs and Fosberg	Hubbs and Strawn	Hubbs and Fosburg	Hubbs
Locality:	At Kerrville	Three miles E of Comfort	At Kerrville	At Kerrville State Park	Three miles E of Comfort	Two miles W of Ingram	Three miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	5	1	2	26	4	2
<i>Cyprinella lutrensis</i>	-	261	42	-	93	-	32
<i>Cyprinella lutrensis X venus</i>	-	-	24	-	-	-	-
<i>Cyprinella venusta</i>	96	16	170	125	10	6	5
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	6	-	3	-	1	-	-
<i>Notropis anabilis</i>	-	-	2	-	2	-	-
<i>Notropis stramineus</i>	-	-	25	-	-	-	-
<i>Notropis volucellus</i>	2	-	-	1	22	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	11	5	-	2	17	-	1
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	1	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	1	1	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	3	-	8	-	-	-	-
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	10/2/1954	10/2/1954	11/7/1954	11/7/1954	11/28/1954	12/5/1954 ^a	12/5/1954
Collector:	Hubbs	Hubbs	Hubbs and Fosberg	Hubbs and Fosberg	Hubbs and Strawn	Hubbs and Fosburg	Hubbs
Locality:	At Kerrville	Three miles E of Comfort	At Kerrville	At Kerrville State Park	Three miles E of Comfort	Two miles W of Ingram	Three miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macro</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis megalotis</i>	-	-	-	-	1	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	2	-	-	-	-
<i>Micropterus sp X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	14	-
<i>Etheostoma spectabile</i>	6	-	31	15	67	18	67
<i>Percina carbonaria</i>	-	-	2	1	6	-	2
<i>Percina apristis</i>	-	1	-	-	3	-	1
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	-
Total	124	288	310	147	250	42	110

^aCollection not used in analyses

Date:	12/5/1954	12/5/1954	12/5/1954	12/5/1954	2/6/1955 ^a	2/6/1955 ^a	2/6/1955
Collector:	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs et al
Locality:	Three miles E of Kerrville	Four miles E of Center Point	At Center Point	At Kerrville	Four miles E of Ingram	At Center Point	Three miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	2	5	-	2	-	-	2
<i>Cyprinella lutrensis</i>	14	48	23	6	-	20	43
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	65	-	26	37	86	37	2
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marcomis</i>	1	1	-	2	-	-	1
<i>Notropis amabilis</i>	1	5	-	1	-	-	-
<i>Notropis stramineus</i>	-	1	-	2	3	7	-
<i>Notropis volucellus</i>	15	-	-	7	-	-	1
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	1	-	-	15	-	-	7
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Ermyzon suetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	7
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	-
<i>Pylocheilichthys olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	1	6	3	16	2	-
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	12/5/1954	12/5/1954	12/5/1954	12/5/1954	2/6/1955^a	2/6/1955^a	2/6/1955
Collector:	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs et al.
Locality:	Three miles E of Kerrville	Four miles E of Center Point	At Center Point	At Kerrville	Four miles E of Ingram	At Center Point	Three miles E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macroch</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochurus</i>	-	-	2	-	-	-	-
<i>Lepomis megalotis</i>	-	-	-	-	-	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculi</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	1	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	19	73	3	5	5	-	39
<i>Percina carbonaria</i>	2	1	-	1	-	-	7
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	1	-	-	-	-
Total	121	135	61	81	110	66	109

^aCollection not used in analyses

Date:	2/6/1955	2/6/1955	3/6/1955	3/6/1955	3/6/1955	5/8/1955	5/8/1955
Collector:	Hubbs	Hubbs	Hubbs	Hubbs and Trevino	Hubbs and Trevino	Hubbs	Hubbs
Locality:	Three miles E of Kerrville	Five miles E of Center Point	Three miles E of Ingram	Three miles E of Kerrville	At Kerrville	Three miles E of Comfort	At Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	1	1	-	-	6	21	1
<i>Cyprinella lutrensis</i>	27	69	-	18	10	77	31
<i>Cyprinella lutrensis X venus</i>	-	-	-	138	5	-	-
<i>Cyprinella venusta</i>	81	18	78	19	49	7	15
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	-	4	-	-
<i>Notropis amabilis</i>	-	4	-	-	1	25	1
<i>Notropis stramineus</i>	-	8	5	-	4	-	-
<i>Notropis volucellus</i>	2	49	-	1	16	-	1
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	2	-	-	-
<i>Pimephales vigilax</i>	5	30	-	-	44	4	-
<i>Carpododes carpio</i>	-	-	-	-	-	-	-
<i>Erismyzon sucetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	2	-	-	-	3	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	1	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	1	-	2	22	4	17	1
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	2/6/1955	2/6/1955	3/6/1955	3/6/1955	3/6/1955	5/8/1955	5/8/1955
Collector:	Hubbs	Hubbs	Hubbs	Hubbs and Trevino	Hubbs and Trevino	Hubbs	Hubbs
Locality:	Three miles E of Kerrville	Five miles E of Center Point	Three miles E of Ingram	Three miles E of Kerrville	At Kerrville	Three miles E of Comfort	At Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	1	-	-	-	-	-	1
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	3	-	1
<i>Lepomis macrochirus</i>	-	-	-	-	6	-	1
<i>Lepomis megalotis</i>	-	-	1	-	6	-	-
<i>Lepomis microlophus</i>	-	-	-	-	2	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	1	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	11	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	21	-	-	-	3	-	-
<i>Etheostoma spectabile</i>	-	2	1	6	44	11	-
<i>Percina carbonaria</i>	1	-	-	-	2	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	1	-	-	-	-	-	-
Total	141	183	87	206	209	178	53

^aCollection not used in analyses

Date:	5/8/1955	8/5/1955	9/21/1955	9/21/1955	9/21/1955	9/21/1955	9/21/1955
Collector:	Hubbs	Suttikus and Chupman	Hubbs	Hubbs and Springer	Hubbs	Hubbs and Springer	Hubbs and Springer
Locality:	At Kerrville State Park	At Comfort, US Hwy 87	At Center Point	Three miles E of Comfort	Three miles E of Center Point	At Kerrville	At Kerrville State Park
Source:	TNHC	Tulane	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	-	1	1	1	2	-
<i>Cyprinella lutrensis</i>	16	40	22	35	-	54	20
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	27	-
<i>Cyprinella venusta</i>	35	14	21	-	25	111	58
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	1	2	-	1	10	16	2
<i>Notropis amabilis</i>	1	2	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	1	-	-	-	-	14	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	4	3	-	-	44	1
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erismyza suetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	17	-	29	1	8	-
<i>Pylodictis olivaris</i>	-	1	-	2	-	-	-
<i>Gambusia affinis</i>	2	10	-	-	2	-	-
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Memidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	5/8/1955	8/5/1955	9/21/1955	9/21/1955	9/21/1955	9/21/1955	9/21/1955
Collector:	Hubbs	Suttkus and Chipman	Hubbs	Hubbs and Springer	Hubbs	Hubbs and Springer	Hubbs and Springer
Locality:	At Kerrville State Park	At Comfort, US Hwy 87	At Center Point	Three miles E of Comfort	Three miles E of Center Point	At Kerrville	At Kerrville State Park
Source:	TNHC	Tulane	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>	-	5	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	5	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	3	-	-	-	-	-
<i>Lepomis megalotis</i>	-	17	-	-	-	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	1	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	1	-	-	-	-	-
<i>Micropterus sp. X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	3	1	2	2	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	35
<i>Etheostoma spectabile</i>	7	3	14	33	9	30	-
<i>Percina carbonaria</i>	2	10	1	27	21	19	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	2	1	-	-	-	-
Total	66	139	64	130	71	325	116

^aCollection not used in analyses

Date:	11/25/1955	11/25/1955	1/14/1956	7/17/1956 ^a	7/17/1956	7/17/1956	7/17/1956
Collector:	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs and Strawn	Hubbs	Hubbs and Strawn
Locality:	Three miles E of Comfort	At Kerrville State Park	At Kerrville State Park	Three miles E of Ingram	Three miles W of Comfort	Two miles W of Ingram	At Kerrville
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	2	4	2	-	16	1	-
<i>Cyprinella lutrensis</i>	67	5	11	-	74	1	7
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	12	-	-
<i>Cyprinella venusta</i>	4	39	42	30	3	2	27
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	2	2	1	-	6	-	-
<i>Notropis amabilis</i>	-	-	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	1	-	-	10
<i>Notropis volucellus</i>	-	-	-	-	-	-	1
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	1	-	-	-	-	-	-
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Ermyzon sucetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	1	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	2	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	1	-	-	-	-
<i>Pylodictus olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	-	-	31	85	221	192
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Memidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	11/25/1955	11/25/1955	1/14/1956	7/17/1956^a	7/17/1956	7/17/1956	7/17/1956
Collector:	Hubbs	Hubbs	Hubbs	Hubbs	Hubbs and Strawn	Hubbs	Hubbs and Strawn
Locality:	Three miles E of Comfort	At Kerrville State Park	At Kerrville State Park	Three miles E of Ingram	Three miles W of Comfort	Two miles W of Ingram	At Kerrville
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	3
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	1	-
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis megalotis</i>	-	-	-	1	15	-	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	5	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	14	2
<i>Micropterus sp. X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	1	-	-	4	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	2
<i>Etheostoma spectabile</i>	16	45	37	-	59	-	13
<i>Percina carbonaria</i>	-	-	-	-	1	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	2
Total	93	96	94	63	277	245	259

^aCollection not used in analyses

Date:	1/14/1957 ^a	9/27/1957	9/28/1957	9/28/1957	11/9/1957	11/9/1957	11/9/1957
Collector:	Hubbs	Hubbs	Hubbs	Hubbs and McGuire	Hubbs	Hubbs	Hubbs
Locality:	Three miles E of Comfort	At Kerrville	Five miles E of Comfort	At Center Point	Three miles E of Comfort	Two miles W of Ingram	Five miles E of Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	10	-	1	5	1	-	1
<i>Cyprinella lutrensis</i>	2	37	317	70	91	7	268
<i>Cyprinella lutrensis X venus</i>	-	-	-	43	-	-	61
<i>Cyprinella venusta</i>	-	138	-	50	9	22	16
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaenata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	-	2	-	-
<i>Notropis amabilis</i>	-	-	-	2	1	1	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	-	-	-	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-
<i>Carpodes carpio</i>	-	-	-	-	-	-	-
<i>Erumyzon suetta</i>	-	-	-	-	-	-	-
<i>Mniotremis melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	3	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	1	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	1	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	10	24	2	9	-	9
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	1/14/1957 ^a	9/27/1957	9/28/1957	9/28/1957	11/9/1957	11/9/1957	11/9/1957
Collector:	Hubbs	Hubbs	Hubbs	Hubbs and McGuire	Hubbs	Hubbs	Hubbs
Locality:	Three miles E of Comfort	At Kerrville	Five miles E of Comfort	At Center Point	Three miles E of Comfort	Two miles W of Ingram	Five miles E of Center Point
Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepomis auritus</i>	-	3	-	22	-	2	2
<i>Lepomis cyanellus</i>	-	2	-	-	23	-	3
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	1	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	6	-	-	-	4	-
<i>Lepomis megalotis</i>	-	1	-	-	20	-	3
<i>Lepomis microlophus</i>	-	3	-	-	-	1	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	1	-	-	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	9	-
<i>Etheostoma spectabile</i>	37	5	1	-	-	29	-
<i>Percina carbonaria</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	1	3	-	4	-	1
Total	50	207	347	194	160	79	364

^aCollection not used in analyses

Date:	11/9/1957	11/9/1957	10/9/1960	1/1/1961	1/1/1961	1/1/1961	1/1/1961
Collector:	Hubbs	Hubbs	Collette	Dietz et al	Dietz et al	Dietz et al	Dietz et al
Locality:	At Center Point	At Kerrville	Two miles W of Kerrville	At Hunt, Hwy 39 crossing	At Old Ingram Dam	Below Flat Rock Dam	At Naylor Ranch
Source:	TNHC	TNHC	NMNH	TGFC 1962	TGFC 1962	TGFC 1962	TGFC 1962
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	9
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	24
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	5	2	18	3	1	8	-
<i>Cyprinella lutrensis</i>	39	16	1	9	-	1	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	1	-
<i>Cyprinella venusta</i>	74	26	161	30	15	47	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	-	-	-	-
<i>Notropis amabilis</i>	-	5	11	11	-	-	-
<i>Notropis stramineus</i>	-	-	8	-	6	49	-
<i>Notropis volucellus</i>	-	-	-	-	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-
<i>Carpionodes carpio</i>	-	-	-	-	-	-	7
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	1	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	21
<i>Astyanax mexicanus</i>	-	-	14	11	1	1	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	3	-	1	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	4
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	1	6	17	13	5	3	-
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	1	-

Date:	11/9/1957	11/9/1957	10/9/1960	1/1/1961	1/1/1961	1/1/1961	1/1/1961
Collector:	Hubbs	Hubbs	Collette	Dietz et al.	Dietz et al.	Dietz et al.	Dietz et al.
Locality:	At Center Point	At Kerrville	Two miles W of Kerrville	At Hunt, Hwy 39 crossing	At Old Ingram Dam	Below Flat Rock Dam	At Naylor Ranch
Source:	TNHC	TNHC	NMNH	TGFC 1962	TGFC 1962	TGFC 1962	TGFC 1962
<i>Lepomis auritus</i>	-	8	-	5	4	1	-
<i>Lepomis cyanellus</i>	-	-	-	1	3	2	1
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	12	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	7	3	-	-	1	2
<i>Lepomis megalotis</i>	-	-	26	6	1	-	-
<i>Lepomis microlophus</i>	-	3	2	2	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	1
<i>Lepomis sp</i>	-	-	6	-	-	-	-
<i>Micropterus salmoides</i>	-	-	9	3	5	2	2
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	-	-	2	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	13	2	7	-	-
<i>Etheostoma spectabile</i>	5	12	5	4	5	-	-
<i>Percina carbonaria</i>	-	-	8	-	3	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	3	2	3	2	-
Total	124	97	306	105	59	122	71

^aCollection not used in analyses

Date:	1/1/1961	1/1/1961	1/1/1961	1/1/1961	9/23/1969^a	12/17/1969^a	7/17/1972
Collector:	Dietz et al	Dietz et al.	Dietz et al	Dietz et al	Butler et al	Butler et al	Suttkus et al
Locality:	At Adams Ranch	At Spanish Oak Lodges in Comfort, TX	At El Max Ranch	At KWW Ranch near Nick Golden Residence	Kerr county	Comal county	At comfort I-10 Crossing
Source:	TGFC 1962	TGFC 1962	TGFC 1962	TGFC 1962	TGCF 1973	TGCF 1973	Tulane
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	4	7	4	16	-	-	-
<i>Dorosoma cepedianum</i>	19	16	19	10	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	-	-	3	-	-	44
<i>Cyprinella lutrensis</i>	-	5	-	1	-	-	10
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	4
<i>Cyprinella venusta</i>	-	6	-	-	-	-	182
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marcomis</i>	-	-	-	1	-	-	-
<i>Notropis amabilis</i>	-	33	-	10	-	-	27
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	-	-	-	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-
<i>Carpionodes carpio</i>	11	6	-	4	1	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	28	5	6	5	11	24	1
<i>Astyanax mexicanus</i>	-	6	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	3	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	2
<i>Ictalurus punctatus</i>	4	13	6	2	-	-	-
<i>Pylodictis olivaris</i>	1	2	2	-	2	-	-
<i>Gambusia affinis</i>	-	-	-	13	-	-	1
<i>Poecilia latipinna</i>	-	-	-	1	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	1/1/1961	1/1/1961	1/1/1961	1/1/1961	9/23/1969^a	12/17/1969^a	7/17/1972
Collector:	Dietz et al.	Dietz et al.	Dietz et al.	Dietz et al.	Butler et al.	Butler et al.	Suttkus et al.
Locality:	At Adams Ranch	At Spanish Oak Lodges in Comfort, TX	At El Max Ranch	At KWW Ranch near Nick Golden Residence	Kerr county	Comal county	At comfort I-10 Crossing
Source:	TGFC 1962	TGFC 1962	TGFC 1962	TGFC 1962	TGCF 1973	TGCF 1973	Tulane
<i>Lepomis auritus</i>	-	2	10	4	-	-	-
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	2
<i>Lepomis cyanellus X macro-</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	7	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	6	1	-	-	11
<i>Lepomis megalotis</i>	-	1	-	-	-	-	3
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	2	-
<i>Micropterus salmoides</i>	-	-	2	-	-	-	4
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	4	-	4	-	-	2
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	1	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	-	1	-	-	39
<i>Percina carbonaria</i>	-	1	-	-	-	-	19
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	4	1	-	-	1
Total	67	107	70	77	14	26	352

^aCollection not used in analyses

	Date:	2/27/1976	6/23/1978^a	12/16/1978	3/11/1982^a	4/30/1985^a	5/3/1985^a	7/22/1986
	Collector:	Suttikus and Prehmus	Matthews and Shepard	Edwards	Humphries and Cashner	Retzer and Page	Retzer and Page	Hubbs and Morales
	Locality:	One mile E of Comfort, I-10	At Center Point (Eileen Peirce's property)	At Center Point	At low water bridge at US 87 at Comfort	MO Ranch	At Spring Branch	Three miles E of Ingram
	Source:	Tulane	OMNH	TNHC	UMMZ	TCWC	TCWC	TNHC
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-	5
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	4	-	-	-	-	3	-	32
<i>Cyprinella lutrensis</i>	-	5	3	7	19	-	-	-
<i>Cyprinella lutrensis X venusta</i>	21	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	90	37	41	10	-	14	-	31
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-	5
<i>Macrhybopsis marconis</i>	-	-	-	5	-	-	-	-
<i>Notropis amabilis</i>	-	19	13	7	2	1	-	18
<i>Notropis stramineus</i>	-	-	-	-	2	-	-	6
<i>Notropis volucellus</i>	9	-	1	-	-	13	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-	-
<i>Carpiodes carpio</i>	-	-	-	-	-	-	-	-
<i>Erismyzon sucetta</i>	-	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	-	-	-	-	10
<i>Astyanax mexicanus</i>	-	-	-	-	1	-	-	-
<i>Amenurus melas</i>	-	-	-	-	-	-	-	-
<i>Amenurus natalis</i>	-	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	2	-	-	1	-	-	-	1
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	-	-	-	-	-	-	23
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-	-

	Date:	2/27/1976	6/23/1978^a	12/16/1978	3/11/1982^a	4/30/1985^a	5/3/1985^a	7/22/1986
	Collector:	Suttikus and Prehmus	Matthews and Shepard	Edwards	Humphries and Cashner	Retzer and Page	Retzer and Page	Hubbs and Morales
	Locality:	One mile E of Comfort, I-10	At Center Point (Eileen Peirce's property)	At Center Point	At low water bridge at US 87 at Comfort	MO Ranch	At Spring Branch	Three miles E of Ingram
	Source:	Tulane	OMNH	TNHC	UMMZ	TCWC	TCWC	TNHC
<i>Lepomis auritus</i>	-	-	-	-	-	-	-	3
<i>Lepomis cyanellus</i>	-	-	-	-	-	-	-	1
<i>Lepomis cyanellus X macro</i>	-	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-	1
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-	4
<i>Lepomis megalotis</i>	-	-	2	1	-	2	4	4
<i>Lepomis microlophus</i>	-	-	-	-	-	-	1	1
<i>Lepomis minatus</i>	-	-	-	-	-	-	2	2
<i>Lepomis sp</i>	-	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	2	2
<i>Micropterus sp. X sp.</i>	1	-	-	-	-	-	2	2
<i>Micropterus treculii</i>	2	4	-	1	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	3	-	-
<i>Etheostoma spectabile</i>	20	-	1	-	-	2	14	14
<i>Percina carbonaria</i>	6	-	7	4	-	3	12	12
<i>Percina apristis</i>	-	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	1	1
Total	155	65	68	36	27	38	178	

^aCollection not used in analyses

Date:	7/22/1986	7/22/1986	11/29/1986	11/29/1986	5/1/1994	5/1/1994	5/1/1994
Collector:	Hubbs and Morales	Hubbs and Morales	Hubbs and Stevens	Hubbs and Stevens	Terre et al	Terre et al	Terre et al
Locality:	At Legion	Five miles E of Center Point	Three miles E of Comfort	Two miles W of Ingram	SE of Comfort	SE of Comfort	E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	1	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	6	-	-	-	12	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	1	5	-	3	4	-	8
<i>Cyprinella lutrensis</i>	-	-	29	-	3	-	15
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	6	29	200	84	268	409	201
<i>Cyprinus carpio</i>	-	-	-	-	-	34	2
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marcomis</i>	-	-	-	-	2	-	2
<i>Notropis amabilis</i>	2	90	22	35	36	-	54
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	2	5	16	7	13	-	142
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	11	-	-	-	1	-	-
<i>Carpodes carpio</i>	-	1	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Mniytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	3	4	-	-	6	1	4
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	1	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	45	-	-	-	-	3
<i>Pylodictis olivaris</i>	-	1	-	-	1	-	-
<i>Gambusia affinis</i>	33	4	6	1	54	7	11
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	9	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	7/22/1986	7/22/1986	11/29/1986	11/29/1986	5/1/1994	5/1/1994	5/1/1994
Collector:	Hubbs and Morales	Hubbs and Morales	Hubbs and Stevens	Hubbs and Stevens	Terre et al.	Terre et al.	Terre et al.
Locality:	At Legion	Five miles E of Center Point	Three miles E of Comfort	Two miles W of Ingram	SE of Comfort	SE of Comfort	E of Comfort
Source:	TNHC	TNHC	TNHC	TNHC	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Lepomis auritus</i>	1	-	1	5	18	4	7
<i>Lepomis cyanellus</i>	1	-	-	3	-	-	1
<i>Lepomis cyanellus X macroch</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	9	3	11	2	-	-	-
<i>Lepomis megalotis</i>	8	4	-	10	11	-	1
<i>Lepomis microlophus</i>	3	-	1	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	1	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	18	2	-	1	1	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus trecuhi</i>	1	10	-	-	13	3	2
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	34	-	-	7	-	-	-
<i>Etheostoma spectabile</i>	-	17	9	5	4	2	-
<i>Percina carbonaria</i>	1	-	-	1	2	-	2
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	3	-	1	-	3	1	4
Total	154	220	296	164	453	461	459

^aCollection not used in analyses

Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
Collector:	Terre et al	Terre et al	Terre et al	Terre et al	Terre et al	Terre et al	Terre et al
Locality:	E of Comfort	At FM 1621 crossing	At Zoeller Lane	At FM 1376	At FM 474	Near FM 3351	Downstream of FM 3351
Source:	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	1	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	1	1	-	-	13	-	-
<i>Cyprinella lutrensis</i>	7	-	-	7	-	-	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	111	73	125	283	38	97	17
<i>Cyprinus carpio</i>	-	1	-	5	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	2	-	-	-	-	-	-
<i>Notropis amabilis</i>	69	4	36	14	79	7	4
<i>Notropis stramineus</i>	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	59	97	32	39	103	15	120
<i>Notropis sp</i>	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	1
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	4	1	3	24	1	5	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	7	-	1	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	5	-	30	13	1	-	2
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-

Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
Collector:	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
Locality:	E of Comfort	At FM 1621 crossing	At Zoeller Lane	At FM 1376	At FM 474	Near FM 3351	Downstream of FM 3351
Source:	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Lepomis auritus</i>	17	4	1	11	2	1	18
<i>Lepomis cyanellus</i>	1	4	-	-	-	-	7
<i>Lepomis cyanellus X macrochirus</i>	-	-	-	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	5	1	-	1	-	-	-
<i>Lepomis megalotis</i>	1	1	-	2	-	20	3
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	-	-	-	-	-
<i>Micropterus sp. X sp.</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	4	2	4	11	-	4	2
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	11	8	11	3	3
<i>Percina carbonaria</i>	-	1	-	1	4	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	-
Total	286	191	242	426	252	153	177

^aCollection not used in analyses

	Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	9/20/1994	6/25/1995
	Collector:	Terre et al	Terre et al	Terre et al	Terre et al	Terre et al	Calvino et al	Matthews and Marsh
	Locality:	At CR-31	At Spring Branch Road crossing	Upstream of Hwy 281 crossing	Near FM 311	At Rebecca Creek Road crossing	Between Hwy 87 and IH 10 bridge crossing	At Center Point (Eileen Pierce's property)
	Source:	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	TNHC	OMNH
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	1	-	-	-	2	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	1	210	-	-
<i>Dorosoma petenense</i>	-	-	-	-	-	15	-	-
<i>Campostoma anomalum</i>	-	5	2	-	-	-	1	38
<i>Cyprinella lutrensis</i>	-	-	-	-	-	-	3	-
<i>Cyprinella lutrensis X venus</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	121	206	243	84	1	173	148	148
<i>Cyprinus carpio</i>	5	-	-	5	14	-	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	1	-	2	11	11
<i>Notropis amabilis</i>	41	1	4	60	-	13	35	35
<i>Notropis stramineus</i>	-	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	14	1	-	1	-	13	54	54
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	2	2	1	-	-
<i>Carpionodes carpio</i>	-	-	-	1	-	-	-	-
<i>Erimyzon sucetta</i>	-	-	-	-	-	-	-	-
<i>Mniotremis melanops</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	9	-	-	4	2	1	-	-
<i>Astyanax mexicanus</i>	-	-	2	1	-	-	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	3	-	-	-	6	-	1	1
<i>Pylodictis olivaris</i>	-	-	-	-	2	-	-	-
<i>Gambusia affinis</i>	15	-	-	3	-	22	4	4
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	2	2
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-	-

	Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	9/20/1994	6/25/1995
	Collector:	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Calvino et al.	Matthews and Marsh
	Locality:	At CR-31	At Spring Branch Road crossing	Upstream of Hwy 281 crossing	Near FM 311	At Rebecca Creek Road crossing	Between Hwy 87 and IH 10 bridge crossing	At Center Point (Eileen Pierce's property)
	Source:	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	TNHC	OMNH
<i>Lepomis auritus</i>		10	1	9	18	22	2	2
<i>Lepomis cyanellus</i>		-	-	1	9	11	-	-
<i>Lepomis cyanellus X macrochirus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	-	14	-	-
<i>Lepomis macrochirus</i>		-	-	-	4	126	-	-
<i>Lepomis megalotis</i>		-	-	4	13	30	1	-
<i>Lepomis microlophus</i>		1	-	-	-	31	-	-
<i>Lepomis miniatus</i>		-	-	-	-	-	1	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	1	-	4	95	1	-
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		3	1	2	21	11	-	-
<i>Pomoxis annularis</i>		-	-	-	-	7	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		2	11	7	-	-	1	4
<i>Percina carbonaria</i>		1	-	-	-	-	2	1
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	2	3	1	-
Total		226	227	274	236	602	238	300

^aCollection not used in analyses

APPENDIX II

HISTORICAL FISH COLLECTIONS FROM THE LOWER GUADALUPE RIVER

	Date:	2/26/1950	4/6/1950	8/8/1951	8/8/1951	8/8/1951	4/17/1952	5/26/1952
	Collector:	Jurgens and Hallum	Hubbs and Kemp	Hubbs and Williams	Hubbs and Williams	Hubbs and Williams	Kuehne and Ball	Kuehne and Ball
	Locality:	Hwy 29, 0.25 miles SE of Gonzales	S of Belmon at State Hwy 80 crossing	1.5 miles N of Sattler	Two miles NW of Hueco Springs	Three miles S of Sattler	Two miles above Wright's Camp	10 miles S of Gonzales
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	NMNH	NMNH
<i>Lepisosteus oculatus</i>		-	-	-	-	-	3	1
<i>Lepisosteus osseus</i>		-	-	-	1	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		1	4	-	-	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		26	30	75	15	20	-	10
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	2	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		1	3	-	18	9	-	1
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		4	25	-	-	-	-	10
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		1	-	-	-	10	-	6
<i>Notropis Xaenoccephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	6	-
<i>Pimephales vigilax</i>		18	14	19	13	19	-	20
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>		-	-	-	-	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	3	-	-	-	-	2
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	1	-
<i>Ictalurus punctatus</i>		-	-	-	23	10	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	8	-
<i>Pylodictis olivaris</i>		-	-	-	-	2	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	30	-

	Date:	2/26/1950	4/6/1950	8/8/1951	8/8/1951	8/8/1951	4/17/1952	5/26/1952
	Collector:	Jurgens and Hallum	Hubbs and Kemp	Hubbs and Williams	Hubbs and Williams	Hubbs and Williams	Kuehne and Ball	Kuehne and Ball
	Locality:	Hwy 29, 0.25 miles SE of Gonzales	S of Belmon at State Hwy 80 crossing	1.5 miles N of Sattler	Two miles NW of Hueco Springs	Three miles S of Sattler	Two miles above Wright's Camp	10 miles S of Gonzales
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	NMNH	NMNH
<i>Gambusia affinis</i>		3	13	-	7	12	10	9
<i>Poecilia latipinna</i>		-	-	6	-	-	26	1
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		1	-	-	-	-	4	-
<i>Lepomis gulosus</i>		-	-	3	-	2	25	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	-	10	-	2	-	-
<i>Lepomis megalotis</i>		-	2	11	-	-	-	-
<i>Lepomis microlophus</i>		-	-	-	-	-	-	-
<i>Lepomis minimus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	99	15
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	8	-
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	5
<i>Micropterus treculi</i>		-	-	-	7	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	20	-
<i>Etheostoma gracile</i>		-	-	-	-	-	16	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	6	-	-
<i>Percina carbonaria</i>		2	-	20	-	8	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	1	-
<i>Percina apristis</i>		1	1	-	15	6	-	-
<i>Percina shumardi</i>		4	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		1	-	-	7	-	7	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	2/26/1950	4/6/1950	8/8/1951	8/8/1951	8/8/1951	4/17/1952	5/26/1952
	Collector:	Jurgens and Hallum	Hubbs and Kemp	Hubbs and Williams	Hubbs and Williams	Hubbs and Williams	Kuehne and Ball	Kuehne and Ball
	Locality:	Hwy 29, 0.25 miles SE of Gonzales	S of Belmon at State Hwy 80 crossing	1.5 miles N of Sattler	Two miles NW of Hueco Springs	Three miles S of Sattler	Two miles above Wright's Camp	10 miles S of Gonzales
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	NMNH	NMNH
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		63	97	144	106	106	264	80

^aCollection not used in analyses; ^bMisidentification Native to Alabama, voucher is TNHC #279

	Date:	10/13/1952	10/13/1952	3/8/1953	6/5/1953	7/13/1954	2/29/1976	3/15/1976
	Collector:	Kuehne and Ball	Kuehne and Ball	Hubbs and White	Kuehne and Ball	Hubbs	WFS 312 Class	Cross, Wiley et al.
	Locality:	At Dunlap Lake, Camp Willow Dock	At Victoria City Park	Three miles SW of Cuero	Hwy 183, 2 miles SE of Gonzales	One mile N of Sattler	0 75 miles NE of loop 175 near Victoria	US 183, 1 mile S of Gonzales
	Source:	NMNH	NMNH	TNHC	NMNH	TNHC	TCWC	KU
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	1	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	-	-	1	-	-
<i>Cyprinella lutrensis</i>		41	11	33	25	31	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	61
<i>Cyprinella venusta</i>		-	-	1	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	-	20	-	-	5	2
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	10	11	-	-	6	-
<i>Notropis stramineus</i>		-	-	-	-	1	-	-
<i>Notropis volucellus</i>		-	-	3	-	-	-	-
<i>Notropis Xaenoccephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		6	8	-	36	-	-	-
<i>Opsopoeodus emiliae</i>		2	-	-	-	-	26	-
<i>Pimephales vigilax</i>		11	1	1	2	-	-	-
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	1
<i>Astyanax mexicanus</i>		-	-	-	-	-	14	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		8	6	-	-	-	-	-

	Date:	10/13/1952	10/13/1952	3/8/1953	6/5/1953	7/13/1954	2/29/1976	3/15/1976
	Collector:	Kuehne and Ball	Kuehne and Ball	Hubbs and White	Kuehne and Ball	Hubbs	WFS 312 Class	Cross, Wiley et al.
	Locality:	At Dunlap Lake, Camp Willow Dock	At Victoria City Park	Three miles SW of Cuero	Hwy 183, 2 miles SE of Gonzales	One mile N of Sattler	0.75 miles NE of loop 175 near Victoria	US 183, 1 mile S of Gonzales
	Source:	NMNH	NMNH	TNHC	NMNH	TNHC	TCWC	KU
<i>Gambusia affinis</i>		15	15	-	2	-	-	-
<i>Poecilia latipinna</i>		74	2	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	-	24
<i>Lepomis gulosus</i>		-	-	-	-	-	-	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	-	-	-	-	-	-
<i>Lepomis megalotis</i>		-	-	-	-	1	-	-
<i>Lepomis microlophus</i>		-	-	-	-	-	1	-
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		4	3	-	7	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	1	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	-
<i>Micropterus sp. X sp.</i>		-	-	-	10	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	7	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	1	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	11	-	-
<i>Percina carbonaria</i>		-	-	-	-	28	-	-
<i>Percina macrolepidia</i>		-	1	-	3	-	-	-
<i>Percina apristis</i>		-	-	4	-	1	-	5
<i>Percina shumardi</i>		-	-	39	-	-	-	5
<i>Cichlasoma cyanoguttatum</i>		4	3	-	-	-	-	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	10/13/1952	10/13/1952	3/8/1953	6/5/1953	7/13/1954	2/29/1976	3/15/1976
	Collector:	Kuehne and Ball	Kuehne and Ball	Hubbs and White	Kuehne and Ball	Hubbs	WFS 312 Class	Cross, Wiley et al
	Locality:	At Dunlap Lake, Camp Willow Dock	At Victoria City Park	Three miles SW of Cuero	Hwy 183, 2 miles SE of Gonzales	One mile N of Sattler	0 75 miles NE of loop 175 near Victoria	US 183, 1 mile S of Gonzales
	Source:	NMNH	NMNH	TNHC	NMNH	TNHC	TCWC	KU
<i>Mugil cephalus</i>		-	-	8	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		165	60	120	85	83	53	98

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	4/20/1980	3/24/1981	8/18/1982 ^a	3/9/1986	3/2/1991	3/2/1991	6/8/1991
	Collector:	McCoid and McCoid	Mosier and Hillis	Mosier and Tiebel	Hubbs and Yan	Whiteside and Arsuffi	Whiteside and Arsuffi	Whiteside and Arsuffi
	Locality:	River Raod N of New Braunfels /Gruene	U.S. Hwy 183 just S of Gonzales	Hwy 183, S of Gonzales	Three miles SW of Cuero	At Cuero Lake	At FM 3402, 2 miles W of Cuero	At FM 3402, 2 miles W of Cuero
	Source:	TCWC	TNHC	TNHC	TNHC	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991
<i>Lepisosteus oculatus</i>		-	-	-	-	1	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	1	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	5	1	17
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	30	21	357	32	372	202
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		29	19	3	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	10	-	-	-	-	-
<i>Notropis amabilis</i>		124	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	92	-	3	1
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		95	-	-	-	-	-	-
<i>Notropis Xaenocephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	2	-	101	20	39	-
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	1	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		1	-	-	-	-	1	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	1	2	-
<i>Noturus gyrinus</i>		-	-	-	-	-	1	-
<i>Pylodictus olivaris</i>		-	-	-	-	-	-	1
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-

	Date:	4/20/1980	3/24/1981	8/18/1982 ^a	3/9/1986	3/2/1991	3/2/1991	6/8/1991
	Collector:	McCoid and McCoid	Mosier and Hillis	Mosier and Tiebel	Hubbs and Yan	Whiteside and Arsuffi	Whiteside and Arsuffi	Whiteside and Arsuffi
	Locality:	River Raod N of New Braunfels /Gruene	U.S. Hwy 183 just S of Gonzales	Hwy 183, S of Gonzales	Three miles SW of Cuero	At Cuero Lake	At FM 3402, 2 miles W of Cuero	At FM 3402, 2 miles W of Cuero
	Source:	TCWC	TNHC	TNHC	TNHC	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991
<i>Gambusia affinis</i>		10	10	-	6	2	6	-
<i>Poecilia latipinna</i>		-	1	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	1	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	1	-	-	-
<i>Lepomis humilis</i>		-	3	-	6	-	1	-
<i>Lepomis macrochirus</i>		-	-	-	-	2	2	-
<i>Lepomis megalotis</i>		-	-	1	42	7	21	1
<i>Lepomis microlophus</i>		-	-	-	7	-	-	-
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	2	-	-	8	6	1
<i>Micropterus salmoides</i>		1	-	-	-	-	-	-
<i>Micropterus sp. X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	1	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		2	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	1	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	2	1	-	-	-	-
<i>Percina shumardi</i>		-	-	-	1	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	-	-	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	4/20/1980	3/24/1981	8/18/1982^a	3/9/1986	3/2/1991	3/2/1991	6/8/1991
	Collector:	McCoid and McCoid	Mosier and Hillis	Mosier and Tiebel	Hubbs and Yan	Whiteside and Arsuffi	Whiteside and Arsuffi	Whiteside and Arsuffi
	Locality:	River Road N of New Braunfels / Gruene	U.S Hwy 183 just S of Gonzales	Hwy 183, S of Gonzales	Three miles SW of Cuero	At Cuero Lake	At FM 3402, 2 miles W of Cuero	At FM 3402, 2 miles W of Cuero
	Source:	TCWC	TNHC	TNHC	TNHC	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991
<i>Mugil cephalus</i>		-	-	-	-	-	2	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		262	80	27	614	79	458	223

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	6/15/1991 ^a	6/15/1991	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
	Collector:	Whiteside and Arsuffi	Whiteside and Arsuffi	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
	Locality:	Upstream of FM 3402 crossing	At Cuero Lake	Just below Canyon Lake Reservoir	At Hwy 306 [first crossing]	Between Hwy 306 1 and 2 crossings	At Hwy 306 crossing [2nd crossing]	River Road crossing [3rd crossing]
	Source:	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		6	44	-	-	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	2	11	3	52	1
<i>Cyprinella lutrensis</i>		6	67	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	2	23	-	-	-
<i>Cyprinus carpio</i>		-	-	6	1	-	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	-	18	119	88	94	7
<i>Notropis buchanani</i>		-	2	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	2	9
<i>Notropis Xaenocephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	5	-	-	1	-	-
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	38	21	34	18	57
<i>Astyanax mexicanus</i>		-	1	-	-	-	-	-
<i>Amenurus natalis</i>		-	-	-	-	-	2	-
<i>Ictalurus punctatus</i>		-	-	54	-	7	4	2
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	1	-	-	3
<i>Oncorhynchus mykiss</i>		-	-	1	-	-	1	1
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-

	Date: 6/15/1991 ^a	6/15/1991	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
Collector:	Whiteside and Arsuffi	Whiteside and Arsuffi	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
Locality:	Upstream of FM 3402 crossing	At Cuero Lake	Just below Canyon Lake Reservoir	At Hwy 306 [first crossing]	Between Hwy 306 1 and 2 crossings	At Hwy 306 crossing [2nd crossing]	River Road crossing [3rd crossing]
Source:	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996	Terre and Magnolia 1996
<i>Gambusia affinis</i>	-	-	8	-	3	16	7
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Morone saxatilis</i>	-	-	-	3	-	-	-
<i>Ambloplites rupestris</i>	-	-	10	9	11	44	-
<i>Lepomis auritus</i>	-	-	-	7	4	7	1
<i>Lepomis cyanellus</i>	-	-	27	-	-	1	1
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-
<i>Lepomis humilis</i>	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	1	1	1	-	-
<i>Lepomis megalotis</i>	-	4	11	-	43	10	-
<i>Lepomis microlophus</i>	-	-	-	-	-	-	-
<i>Lepomis minimus</i>	-	-	5	-	-	1	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>	-	-	-	2	2	4	6
<i>Micropterus punctulatus</i>	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	14	2	4	2	2
<i>Micropterus sp. X sp</i>	-	-	-	-	-	-	-
<i>Micropterus treculii</i>	-	-	-	1	-	-	-
<i>Pomoxis annularis</i>	-	-	1	1	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>	-	-	-	-	-	-	-
<i>Etheostoma gracile</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	4	-	-	3	1
<i>Etheostoma spectabile</i>	-	-	-	4	-	5	3
<i>Percina carbonaria</i>	-	-	4	-	1	2	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	-	-	-	-	-	-	-
<i>Percina shumardi</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	-	-	-
<i>Agonostomus monticola</i>	-	-	-	-	-	-	-

	Date: 6/15/1991 ^a	6/15/1991	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
Collector:	Whiteside and Arsuffi	Whiteside and Arsuffi	Terre et al.	Terre et al	Terre et al	Terre et al.	Terre et al.
Locality:	Upstream of FM 3402 crossing	At Cuero Lake	Just below Canyon Lake Reservoir	At Hwy 306 [first crossing]	Between Hwy 306 1 and 2 crossings	At Hwy 306 crossing [2nd crossing]	River Road crossing [3rd crossing]
Source:	Whiteside and Arsuffi 1991	Whiteside and Arsuffi 1991	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Mugil cephalus</i>	-	-	-	-	-	-	-
<i>Mugil curema</i>	-	-	-	-	-	-	-
<i>Achirus lineatus</i>	-	-	-	-	-	-	-
Total	12	123	206	206	202	268	101

^aCollection not used in analyses, ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
	Collector:	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
	Locality:	Near Simon Ave	Parallel to River Road	Parallel to River Road	At River Road [4th crossing]	At Slumber Falls	At Rail Road near Gruene, Texas	Just downstream of Gruene, Texas
	Source:	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	1	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		5	3	6	-	11	7	-
<i>Cyprinella lutrensis</i>		4	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		82	1	13	70	5	18	-
<i>Cyprinus carpio</i>		-	-	-	4	-	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		222	1387	83	-	30	60	32
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	10	1	-	-
<i>Notropis Xaenocephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		98	1	3	26	4	6	17
<i>Astyanax mexicanus</i>		-	-	-	-	6	-	-
<i>Ameiurus natalis</i>		3	-	-	-	-	1	-
<i>Ictalurus punctatus</i>		24	-	-	-	1	-	3
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	1
<i>Oncorhynchus mykiss</i>		4	-	-	-	-	-	-
<i>Salmo trutta</i>		1	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-

	Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
	Collector:	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
	Locality:	Near Simon Ave	Parallel to River Road	Parallel to River Road	At River Road [4th crossing]	At Slumber Falls	At Rail Road near Gruene, Texas	Just downstream of Gruene, Texas
	Source:	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Gambusia affinis</i>		-	-	-	-	2	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		8	2	5	4	3	1	2
<i>Lepomis auritus</i>		116	11	6	51	4	28	40
<i>Lepomis cyanellus</i>		11	9	3	1	14	2	-
<i>Lepomis gulosus</i>		1	1	1	4	-	-	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		6	-	7	1	1	1	1
<i>Lepomis megalotis</i>		11	-	5	19	16	16	5
<i>Lepomis microlophus</i>		-	-	-	-	-	-	-
<i>Lepomis miniatus</i>		-	-	1	-	-	2	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		33	15	13	19	5	13	2
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		7	-	-	5	3	1	8
<i>Micropterus sp. X sp</i>		3	-	-	-	-	-	-
<i>Micropterus treculii</i>		4	3	1	1	2	1	3
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	1	-	4	-	2	-
<i>Etheostoma spectabile</i>		1	3	1	8	5	2	-
<i>Percina carbonaria</i>		1	-	-	-	-	-	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	1	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	-	-	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994	5/1/1994
	Collector:	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.	Terre et al.
	Locality:	Near Simon Ave	Parallel to River Road	Parallel to River Road	At River Road [4th crossing]	At Slumber Falls	At Rail Road near Gruene, Texas	Just downstream of Gruene, Texas
	Source:	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996	Terre and Magnilia 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		645	1437	148	229	113	161	114

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	5/1/1994	8/28/1995	8/30/1995	9/28/1995	10/3/1995	10/3/1995	10/5/1995
	Collector:	Terre et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	At Hwy 46 crossing in New Braunfels	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Seguin	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16 3 miles S of Gonzales	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Terre and Magnolia 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Lepisosteus oculatus</i>	-	-	-	-	1	1	-	1
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	2	-	-	4	-	14	18
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-	-
<i>Campostoma anomalum</i>	-	-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>	-	33	4	43	62	-	-	87
<i>Cyprinella lutrensis X venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	22	-	-	2	1	-	5
<i>Cyprinus carpio</i>	-	-	-	-	-	55	-	-
<i>Macrhybopsis marconis</i>	-	-	-	-	-	-	-	-
<i>Notropis amabilis</i>	-	-	-	-	-	-	-	-
<i>Notropis buchanani</i>	-	-	-	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	2	27	15	1	-	-	12
<i>Notropis Xaenocephalus</i> ^b	-	-	-	-	-	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	1	2	11	2	-	19
<i>Erimyzon oblongus</i>	-	-	-	-	-	-	-	-
<i>Ichthobus bubalus</i>	-	-	-	-	-	4	-	-
<i>Minytrema melanops</i>	-	-	-	1	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	3	-	-	-	29
<i>Astyanax mexicanus</i>	-	-	7	-	-	-	-	25
<i>Ameiurus natalis</i>	1	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	5	2	-	-	2	-	7
<i>Noturus gyrinus</i>	-	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	1	1	3	-	-
<i>Oncorhynchus mykiss</i>	-	-	-	-	-	-	-	-
<i>Salmo trutta</i>	-	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	1	-	-	-	-	-	-

	Date:	5/1/1994	8/28/1995	8/30/1995	9/28/1995	10/3/1995	10/3/1995	10/5/1995
	Collector:	Terre et al	Longley et al	Longley et al	Longley et al.	Longley et al	Longley et al.	Longley et al.
	Locality:	At Hwy 46 crossing in New Braunfels	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Segum	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16.3 miles S of Gonzales	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Terre and Magnilia 1996	Longley et al. 1996	Longley et al 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al 1996
<i>Gambusia affinis</i>		-	-	-	3	14	-	6
<i>Poecilia latipinna</i>		-	-	-	-	19	-	-
<i>Menidia beryllina</i>		-	2	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		3	-	-	-	-	-	-
<i>Lepomis auritus</i>		27	26	1	-	-	-	-
<i>Lepomis cyanellus</i>		-	3	4	1	8	1	2
<i>Lepomis gulosus</i>		-	-	1	-	-	-	1
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	44	8	2	6	4	14
<i>Lepomis megalotus</i>		4	18	8	4	8	7	10
<i>Lepomis microlophus</i>		-	-	-	-	6	-	12
<i>Lepomis miniatus</i>		4	-	2	-	-	-	4
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	1	1	4	5	4
<i>Micropterus salmoides</i>		1	2	2	3	3	3	4
<i>Micropterus sp. X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		9	-	-	-	-	-	2
<i>Pomoxis annularis</i>		-	-	-	-	-	-	2
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	1	1
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	1	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		1	17	15	-	-	-	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	5/1/1994	8/28/1995	8/30/1995	9/28/1995	10/3/1995	10/3/1995	10/5/1995
	Collector:	Terre et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	At Hwy 46 crossing in New Braunfels	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Seguin	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16.3 miles S of Gonzales	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Terre and Magnolia 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		50	178	83	84	146	102	265

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	12/20/1995	12/28/1995	1/2/1996	1/3/1996	1/4/1996	1/4/1996	2/7/1996
	Collector:	Longley et al	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Segum	Hwy 183, 16 3 miles S of Gonzales	CR-143 crossing, 0 9 miles S of Hwy 90	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Below Dittman Falls
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Lepisosteus oculatus</i>		-	-	6	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		3	2	-	-	-	-	-
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		2	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		8	210	66	182	2	73	32
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		46	-	-	12	-	-	15
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	29	-	1	-	-	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		60	50	10	2	-	-	-
<i>Notropis Xaenocephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	21	35	1	20	15
<i>Erismyzon oblongus</i>		-	-	1	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	1	4	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	38	-	-	-	-	-
<i>Astyanax mexicanus</i>		3	-	-	6	-	-	70
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	19	2	12	2	3	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	1	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		6	-	-	-	-	-	29

	Date:	12/20/1995	12/28/1995	1/2/1996	1/3/1996	1/4/1996	1/4/1996	2/7/1996
	Collector:	Longley et al	Longley et al.	Longley et al	Longley et al	Longley et al.	Longley et al.	Longley et al.
	Locality:	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 16.3 miles S of Gonzales	CR-143 crossing, 0.9 miles S of Hwy 90	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Below Dittman Falls
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Gambusia affinis</i>		122	-	-	-	21	-	100
<i>Poecilia latipinna</i>		2	-	-	-	1	-	-
<i>Menidia beryllina</i>		2	1	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	2	-	-	-	3	-
<i>Lepomis cyanellus</i>		1	-	-	-	-	-	-
<i>Lepomis gulosus</i>		1	-	-	-	-	3	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		41	12	11	22	1	6	56
<i>Lepomis megalotis</i>		36	10	28	19	14	12	22
<i>Lepomis microlophus</i>		-	-	2	16	-	1	-
<i>Lepomis miniatu</i>		1	-	-	-	-	-	3
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	4	-	-	-	-
<i>Micropterus salmoides</i>		-	16	14	9	8	5	1
<i>Micropterus sp. X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	1	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		7	-	2	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		32	-	-	4	2	-	13
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	12/20/1995	12/28/1995	1/2/1996	1/3/1996	1/4/1996	1/4/1996	2/7/1996
	Collector:	Longley et al	Longley et al.	Longley et al.	Longley et al.	Longley et al	Longley et al.	Longley et al.
	Locality:	Below Dittman Falls	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 16.3 miles S of Gonzales	CR-143 crossing, 0.9 miles S of Hwy 90	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Below Dittman Falls
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		373	389	168	320	54	130	356

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	4/2/1996	4/2/1996	4/3/1996	4/3/1996	4/6/1996	5/1/1996	5/7/1996
	Collector:	Longley et al	Longley et al.	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al
	Locality:	Hwy 183, 16.3 miles S of Gonzales	Hwy 87/183, 2 8 miles SW of Cuero	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 7 miles S of Gonzales	CR-143, 0.9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Seguin	Below Dittman Falls
	Source:	Longley et al. 1996	Longley et al 1996	Longley et al 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al 1996
<i>Lepisosteus oculatus</i>		-	-	1	2	-	2	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		3	-	-	2	3	53	4
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		166	514	20	62	270	64	31
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	-	-	1	21
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		1	120	-	-	20	-	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		2	-	4	1	-	-	-
<i>Notropis Xaenoccephalus</i> ^b		24	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	30	-	-	3	-	-
<i>Erinnyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		2	22	10	4	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	30	4	-	20	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	1
<i>Ameiurus natalis</i>		-	200	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	1	41	-	2	7	1
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		1	-	-	-	-	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		3	-	-	-	-	-	3

	Date:	4/2/1996	4/2/1996	4/3/1996	4/3/1996	4/6/1996	5/1/1996	5/7/1996
	Collector:	Longley et al.	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al.	Longley et al
	Locality:	Hwy 183, 16.3 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 7 miles S of Gonzales	CR-143, 0.9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Seguin	Below Dittman Falls
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Gambusia affinis</i>		-	-	-	10	-	9	10
<i>Poecilia latipinna</i>		-	-	-	2	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	10
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	2	-	-	-
<i>Lepomis gulosus</i>		2	-	-	3	1	-	1
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		23	5	1	16	-	8	36
<i>Lepomis megalotis</i>		16	1	14	18	7	15	23
<i>Lepomis microlophus</i>		3	-	-	3	10	3	-
<i>Lepomis miniatus</i>		-	-	4	3	-	-	1
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		2	-	29	5	1	9	1
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	1	-	-	-	1
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	-	1	9
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	4/2/1996	4/2/1996	4/3/1996	4/3/1996	4/6/1996	5/1/1996	5/7/1996
	Collector:	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 183, 16 3 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 7 miles S of Gonzales	CR-143, 0 9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Seguin	Below Dittman Falls
	Source:	Longley et al 1996	Longley et al 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		248	893	155	137	317	192	153

^aCollection not used in analyses, ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	5/8/1996	5/8/1996	5/10/1996 ^a	5/13/1996	6/10/1996	6/11/1996	6/12/1996
	Collector:	Longley et al	Longley et al	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2 8 miles SW of Cuero	Hwy 183, 16.3 miles S of Gonzales	CR-143, 0.9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Segum	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16 3 miles S of Gonzales
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al 1996
<i>Lepisosteus oculatus</i>		1	-	1	-	-	1	2
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	2	-
<i>Dorosoma cepedianum</i>		5	8	-	24	55	11	4
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		283	169	14	111	164	193	48
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	1	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	11	-	-	-	-	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	10	-	-	-	-	15
<i>Notropis Xaenoccephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	5	16	-	5	14
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		4	9	1	-	-	-	1
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	11	-	14	54	6	6
<i>Astyanax mexicanus</i>		-	-	-	-	2	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		4	2	1	8	26	2	1
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		1	-	-	-	-	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-

	Date:	5/8/1996	5/8/1996	5/10/1996 ^a	5/13/1996	6/10/1996	6/11/1996	6/12/1996
	Collector:	Longley et al.	Longley et al	Longley et al.	Longley et al.	Longley et al	Longley et al	Longley et al
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 183, 16.3 miles S of Gonzales	CR-143, 0.9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16.3 miles S of Gonzales
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al 1996	Longley et al. 1996	Longley et al 1996	Longley et al 1996	Longley et al 1996
<i>Gambusia affinis</i>		-	-	-	-	10	-	-
<i>Poecilia latipinna</i>		-	-	-	-	3	-	-
<i>Menidia beryllina</i>		-	-	-	-	372	-	3
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	5	-	-
<i>Lepomis cyanellus</i>		-	-	-	2	2	-	-
<i>Lepomis gulosus</i>		-	-	1	-	-	-	3
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	2	2	5	25	4	10
<i>Lepomis megalotis</i>		15	5	3	11	43	13	16
<i>Lepomis microlophus</i>		-	-	1	19	-	-	-
<i>Lepomis miniatus</i>		-	-	-	1	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	3	-	9
<i>Micropterus salmoides</i>		24	4	10	10	17	-	4
<i>Micropterus sp. X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	1	14	2	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	5/8/1996	5/8/1996	5/10/1996^a	5/13/1996	6/10/1996	6/11/1996	6/12/1996
	Collector:	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	Hwy 183, 16.3 miles S of Gonzales	CR-143, 0.9 miles S of Hwy 90	Hwy 466 crossing, 2 miles S of Seguin	Hwy 183, 7 miles S of Gonzales	Hwy 183, 16.3 miles S of Gonzales
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		337	231	39	223	795	239	136

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	6/12/1996	6/13/1996	6/14/1996	7/2/1996	7/3/1996	7/3/1996	7/4/1996
	Collector:	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 87/183, 2.8 miles SW of Cuero	CR-143, 0.9 miles S of Hwy 90	Below Dittman Falls	Below Dittman Falls	Hwy 183, 16.3 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Lepisosteus oculatus</i>		-	-	-	1	-	-	16
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		1	16	-	-	2	8	29
<i>Dorosoma petenense</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		295	159	-	15	37	118	114
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	17	8	-	29	4
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		4	-	-	-	2	-	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	10	-	-	-	-
<i>Notropis volucellus</i>		18	-	-	-	-	-	-
<i>Notropis Xaenoccephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		7	10	-	-	6	-	3
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		2	-	-	-	2	2	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		2	5	-	-	-	-	10
<i>Astyanax mexicanus</i>		-	-	-	3	2	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	4	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	1	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		3	-	-	-	-	-	-

	Date:	6/12/1996	6/13/1996	6/14/1996	7/2/1996	7/3/1996	7/3/1996	7/4/1996
	Collector:	Longley et al	Longley et al.	Longley et al	Longley et al	Longley et al	Longley et al.	Longley et al.
	Locality:	Hwy 87/183, 2.8 miles SW of Cuero	CR-143, 0.9 miles S of Hwy 90	Below Dittman Falls	Below Dittman Falls	Hwy 183, 16.3 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Gambusia affinis</i>		-	-	1	-	-	-	3
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		3	-	-	-	-	11	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		2	-	4	1	1	-	2
<i>Lepomis cyanellus</i>		1	1	-	-	1	-	-
<i>Lepomis gulosus</i>		-	-	-	2	1	-	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	18	31	36	5	4	14
<i>Lepomis megalotis</i>		16	6	11	4	13	10	9
<i>Lepomis microlophus</i>		-	-	-	-	-	-	-
<i>Lepomis miniatus</i>		-	-	-	-	-	1	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		5	1	-	1	5	4	1
<i>Micropterus salmoides</i>		1	3	4	-	2	2	5
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	1	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	1	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	19	12	-	-	-
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	6/12/1996	6/13/1996	6/14/1996	7/2/1996	7/3/1996	7/3/1996	7/4/1996
	Collector:	Longley et al.	Longley et al.	Longley et al	Longley et al	Longley et al.	Longley et al	Longley et al.
	Locality:	Hwy 87/183, 2.8 miles SW of Cuero	CR-143 , 0.9 miles S of Hwy 90	Below Dittman Falls	Below Dittman Falls	Hwy 183, 16.3 miles S of Gonzales	Hwy 87/183, 2.8 miles SW of Cuero	CR-143 crossing, 0.9 miles S of Hwy 90
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996	Longley et al. 1996
<i>Mugil cephalus</i>		-	-	-	-	-	-	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		360	223	99	83	79	190	210

^aCollection not used in analyses; ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	7/5/1996	7/5/1996	1/8/1997	9/21/1997	10/18/1997	10/25/1997	11/7/1997
	Collector:	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 466 crossing, 2 miles S of Seguin	2.5 miles W of Cuero on Hwy 72	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998
<i>Lepisosteus oculatus</i>	-	-	1	-	-	-	-	1
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	1	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	2	64	-	1	8	3	13	-
<i>Dorosoma petenense</i>	-	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	-	-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>	219	485	33	93	48	26	21	-
<i>Cyprinella lutrensis X venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	1	-	-	-	-	-	-
<i>Notropis amabilis</i>	-	-	-	-	-	-	-	-
<i>Notropis buchanani</i>	-	-	-	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	50	2	-	-	-	-	-
<i>Notropis Xaenoccephalus</i> ^b	-	-	-	-	-	-	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	20	25	1	-	-	-	-	-
<i>Erimyzon oblongus</i>	-	-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>	5	2	1	2	12	5	4	-
<i>Minytrema melanops</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	8	1	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	-	-	-	-	6	-	-
<i>Ameiurus natalis</i>	-	-	-	-	1	-	-	-
<i>Ictalurus punctatus</i>	14	24	-	-	2	2	1	-
<i>Noturus gyrinus</i>	-	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	1	2	-	1	1	-	-	-
<i>Oncorhynchus mykiss</i>	-	-	-	-	-	-	-	-
<i>Salmo trutta</i>	-	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	-	-	-	-	-	-	-

	Date:	7/5/1996	7/5/1996	1/8/1997	9/21/1997	10/18/1997	10/25/1997	11/7/1997
	Collector:	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.	Longley et al.
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 466 crossing, 2 miles S of Seguin	2.5 miles W of Cuero on Hwy 72	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales
	Source:	Longley et al. 1996	Longley et al. 1996	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998
<i>Gambusia affinis</i>		1	74	-	-	-	-	-
<i>Poecilia latipinna</i>		5	13	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	2	-	-	-	-
<i>Lepomis cyanellus</i>		-	1	-	1	-	2	1
<i>Lepomis gulosus</i>		-	1	-	-	-	-	-
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		7	12	7	-	1	4	3
<i>Lepomis megalotis</i>		19	11	2	1	4	1	4
<i>Lepomis microlophus</i>		-	-	-	-	-	-	-
<i>Lepomis minimus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		1	3	-	-	-	-	-
<i>Micropterus salmoides</i>		8	7	-	2	1	4	1
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	20	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	1	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	16	-	-	-	-	2
<i>Agonostomus monticola</i>		-	-	-	-	-	-	-

	Date:	7/5/1996	7/5/1996	1/8/1997	9/21/1997	10/18/1997	10/25/1997	11/7/1997
	Collector:	Longley et al.	Longley et al.	Longley et al	Longley et al.	Longley et al	Longley et al	Longley et al.
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 466 crossing, 2 miles S of Seguin	2.5 miles W of Cuero on Hwy 72	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales	2.5 miles W of Cuero on Hwy 72	Hwy 183, 7 miles S of Gonzales
	Source:	Longley et al 1996	Longley et al. 1996	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al. 1998	Longley et al 1998
<i>Mugil cephalus</i>		-	-	1	2	-	1	-
<i>Mugil curema</i>		-	-	-	-	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	-	-	-
Total		303	800	70	103	78	55	51

^aCollection not used in analyses, ^bMisidentification: Native to Alabama, voucher is TNHC #279

	Date:	11/21/1997 ^a	10/29/1997 ^a	10/25/1999	10/28/1999	10/29/2000	11/2/2000	11/2/2000
	Collector:	Longley et al.	Longley et al.	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 183, 7 miles S of Gonzales	Near Seguin	Near Nursery, TX	Near Victoria, TX	Five miles S. of Gonzales	Hwy 183 crossing in Gonzales
	Source:	Longley et al. 1998	Longley et al. 1998	TPWD	TPWD	TPWD	TPWD	TPWD
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		7	3	-	-	-	18	2
<i>Dorosoma petenense</i>		-	-	1	-	-	-	-
<i>Campostoma anomalum</i>		-	-	2	1	-	-	-
<i>Cyprinella lutrensis</i>		3	7	421	417	1170	300	607
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	8	-	-	-	1
<i>Cyprinus carpio</i>		-	-	-	-	1	-	-
<i>Macrhybopsis marconis</i>		-	-	3	416	27	14	98
<i>Notropis amabilis</i>		-	-	27	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	37	54	102	5
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	1	453	35	10	32	3
<i>Notropis Xaenocephalus</i> ^b		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	1	-	-	-
<i>Pimephales vigilax</i>		3	-	12	425	415	62	9
<i>Erimyzon oblongus</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		7	7	-	-	-	-	-
<i>Minytrema melanops</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	1	2	-	5	2
<i>Astyanax mexicanus</i>		1	-	-	-	2	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	2	-	2	3	1	1
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		3	-	-	-	1	-	-
<i>Oncorhynchus mykiss</i>		-	-	-	-	-	-	-
<i>Salmo trutta</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	1	-

	Date:	11/21/1997 ^a	10/29/1997 ^a	10/25/1999	10/28/1999	10/29/2000	11/2/2000	11/2/2000
	Collector:	Longley et al.	Longley et al.	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 183, 7 miles S of Gonzales	Near Seguin	Near Nursery, TX	Near Victoria, TX	Five miles S. of Gonzales	Hwy 183 crossing in Gonzales
	Source:	Longley et al. 1998	Longley et al. 1998	TPWD	TPWD	TPWD	TPWD	TPWD
<i>Gambusia affinis</i>		1	-	23	70	21	107	2
<i>Poecilia latipinna</i>		-	-	6	19	2	158	3
<i>Menidia beryllina</i>		-	-	1	-	7	1	13
<i>Morone saxatilis</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	1	-	-	-	-
<i>Lepomis cyanellus</i>		-	1	3	10	2	1	1
<i>Lepomis gulosus</i>		-	2	1	-	-	-	1
<i>Lepomis humilis</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	-	3	2	-	15	1
<i>Lepomis megalotis</i>		3	1	36	21	34	77	12
<i>Lepomis microlophus</i>		-	-	-	-	-	1	1
<i>Lepomis miniatus</i>		-	-	2	-	-	15	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	19	20	12	-	12
<i>Micropterus salmoides</i>		-	1	5	-	1	-	1
<i>Micropterus sp. X sp.</i>		-	-	-	-	-	-	-
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	2	-
<i>Pomoxis nigromaculatus</i>		-	-	-	2	-	-	-
<i>Etheostoma chlorosoma</i>		-	-	-	-	-	-	-
<i>Etheostoma gracile</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	11	-	-	-	-
<i>Percina carbonaria</i>		-	-	7	-	-	-	1
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	6	4	1	20
<i>Percina shumardi</i>		-	-	7	9	11	-	17
<i>Cichlasoma cyanoguttatum</i>		-	1	14	11	23	12	23
<i>Agonostomus monticola</i>		-	-	-	1	-	-	6

	Date:	11/21/1997^a	10/29/1997^a	10/25/1999	10/28/1999	10/29/2000	11/2/2000	11/2/2000
	Collector:	Longley et al	Longley et al	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies	TPWD River Studies
	Locality:	Hwy 183, 7 miles S of Gonzales	Hwy 183, 7 miles S of Gonzales	Near Seguin	Near Nursery, TX	Near Victoria, TX	Five miles S. of Gonzales	Hwy 183 crossing in Gonzales
	Source:	Longley et al 1998	Longley et al. 1998	TPWD	TPWD	TPWD	TPWD	TPWD
<i>Mugil cephalus</i>		-	-	-	1	1	-	-
<i>Mugil curema</i>		-	-	-	1	-	-	-
<i>Achirus lineatus</i>		-	-	-	-	1	-	-
Total		28	26	1067	1509	1802	925	842

^aCollection not used in analyses; ^bMisidentification. Native to Alabama, voucher is TNHC #279

APPENDIX III

HISTORICAL FISH COLLECTIONS FROM THE SAN MARCOS RIVER

	Source:	8/1/1884 ^a	9/1/1884 ^a	9/1/1884 ^a	12/4/1891 ^a	12/4/1891 ^a	2/21/1933 ^a	6/22/1938
	Collector:	Jordan and Gilbert	Jordan and Gilbert	Jordan and Gilbert	Evermann	Evermann	Monroe	Hubbs and Party
	Locality:	Just below mouth of Rio Blanco	At San Marcos, TX	At San Marcos, TX	At San Marcos	At San Marcos, TX	At San Marcos	Martindale Bridge, 1 mile S of San Marcos
	Source:	UMMZ	NMNH	NMNH	UMMZ	NMNH	UMMZ	UMMZ
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	-	-	-	-	2
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	12	30	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marcoms</i>		1	17	-	2	7	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	-	10	-	4	-	7
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	7
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	9	-	-	11	-	3
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		1	-	8	-	-	-	-
<i>Carpionodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	1	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	8/1/1884 ^a	9/1/1884 ^a	9/1/1884 ^a	12/4/1891 ^a	12/4/1891 ^a	2/21/1933 ^a	6/22/1938
	Collector:	Jordan and Gilbert	Jordan and Gilbert	Jordan and Gilbert	Evermann	Evermann	Monroe	Hubbs and Party
	Locality:	Just below mouth of Rio Blanco	At San Marcos, TX	At San Marcos, TX	At San Marcos	At San Marcos, TX	At San Marcos	Martindale Bridge, 1 mile S of San Marcos
	Source:	UMMZ	NMNH	NMNH	UMMZ	NMNH	UMMZ	UMMZ
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	3	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	9	7
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	-	10	-	-	1	-
<i>Gambusia geiseri</i>		-	-	-	-	-	12	106
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	-	-	-	-	-	2
<i>Lepomis megalotis</i>		-	-	1	-	15	-	-
<i>Lepomis microlophus</i>		-	-	-	-	-	18	1
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	-	-	-	-	9
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	2
<i>Micropterus sp X sp</i>		-	-	-	-	3	-	-

	Source:	8/1/1884^a	9/1/1884^a	9/1/1884^a	12/4/1891^a	12/4/1891^a	2/21/1933^a	6/22/1938
	Collector:	Jordan and Gilbert	Jordan and Gilbert	Jordan and Gilbert	Evermann	Evermann	Monroe	Hubbs and Party
	Locality:	Just below mouth of Rio Blanco	At San Marcos, TX	At San Marcos, TX	At San Marcos	At San Marcos, TX	At San Marcos	Martindale Bridge, 1 mile S of San Marcos
	Source:	UMMZ	NMNH	NMNH	UMMZ	NMNH	UMMZ	UMMZ
<i>Micropterus treculi</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	1	-	-	-	8	61
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	3	-	3	-	-
<i>Percina carbonaria</i>		-	-	1	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		6	-	25	-	-	-	4
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	-	-	1
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		8	27	62	14	73	48	212

^aCollection not used in analyses

	Source:	6/22/1938	9/12/1949	9/23/1949	9/26/1949	10/5/1949	11/6/1949	11/6/1949
	Collector:	Hubbs and Party	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown
	Locality:	San Marcos below head spring dam	San Marcos near state fish hatchery	Below Ice House dam in San Marcos	Bridge 3 miles SE of State Fish Hatchery	Below icehouse dam in San Marcos	Bridge 0.5 miles W of Marindale	Low-water bridge at Marindale
	Source:	UMMZ	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	1	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	1	-	-	1
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		1	56	-	143	-	55	23
<i>Cyprinella lutrensis X venusta</i>		-	-	-	85	-	-	-
<i>Cyprinella venusta</i>		-	71	-	-	-	42	14
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	1	-	5	-	-
<i>Macrhybopsis marcoms</i>		-	-	-	13	-	1	9
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		97	47	-	33	-	2	-
<i>Hybopsis amnis</i>		-	-	-	2	-	15	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		2	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	3	-	5	-	12	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	2	-
<i>Pimephales vigilax</i>		-	-	-	8	-	106	5
<i>Carpionotus carpio</i>		-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		10	-	5	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	4	2	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	2	-	1	-	-	-

	Source:	6/22/1938	9/12/1949	9/23/1949	9/26/1949	10/5/1949	11/6/1949	11/6/1949
	Collector:	Hubbs and Party	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown
	Locality:	San Marcos below head spring dam	San Marcos near state fish hatchery	Below Ice House dam in San Marcos	Bridge 3 miles SE of State Fish Hatchery	Below icehouse dam in San Marcos	Bridge 0.5 miles W of Marindale	Low-water bridge at Marindale
	Source:	UMMZ	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	2	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	3	2	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		11	2	-	-	-	2	28
<i>Gambusia geiseri</i>		127	37	42	-	6	-	1
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		-	22	-	-	2	7	10
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	3	-	-	1	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		4	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		8	8	16	11	47	6	-
<i>Lepomis megalotis</i>		-	-	-	1	-	11	-
<i>Lepomis microlophus</i>		4	-	-	-	-	-	-
<i>Lepomis mimatus</i>		42	1	74	1	-	-	-
<i>Lepomis punctatus</i>		-	-	-	-	22	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		3	-	3	-	11	-	-
<i>Micropterus sp. X sp</i>		-	-	-	-	-	-	-

	Source:	6/22/1938	9/12/1949	9/23/1949	9/26/1949	10/5/1949	11/6/1949	11/6/1949
	Collector:	Hubbs and Party	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Hubbs	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown
	Locality:	San Marcos below head spring dam	San Marcos near state fish hatchery	Below Ice House dam in San Marcos	Bridge 3 miles SE of State Fish Hatchery	Below icehouse dam in San Marcos	Bridge 0.5 miles W of Marindale	Low-water bridge at Marindale
	Source:	UMMZ	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Micropterus treculii</i>		-	-	-	2	-	2	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		56	2	17	-	10	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	1	-	-	-	-	1
<i>Percina carbonaria</i>		-	1	-	2	-	-	3
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristus</i>		-	9	-	13	-	1	16
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		9	6	-	10	3	7	16
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		374	278	162	332	107	273	127

^aCollection not used in analyses

	Source:	11/11/1949	11/18/1949	12/19/1949 ^a	2/8/1950	2/11/1950	2/18/1950	2/18/1950
	Collector:	Jurgens, K and E R	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown	Jurgens et al	Jurgens et al	Jurgens et al
	Locality:	Low-water bridge 0.5 miles N of Staples	Low-water bridge at Fentress	Below icehouse dam in San Marcos	Low-water bridge 0.5 miles S of Prairie Lea	Bridge 0.5 miles SE of Prairie Lea	US Hwy 90, 3 miles SW of Luling	Low-water bridge at Startown
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	2	-	-	1
<i>Camptostoma anomalum</i>		1	-	-	1	-	1	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		48	174	-	135	116	216	231
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		17	9	-	4	4	-	3
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	2	-	-	-	-
<i>Macrhybopsis marconis</i>		19	19	-	32	-	33	8
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		4	4	-	1	-	-	-
<i>Hybopsis amnis</i>		11	2	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	4	-	52	6
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	1	-
<i>Pimephales promelas</i>		-	-	-	1	-	-	1
<i>Pimephales vigilax</i>		45	64	-	24	40	129	64
<i>Carpodacus carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	4	-	1	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	4	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	12	6	-	-

	Source:	11/11/1949	11/18/1949	12/19/1949 ^a	2/8/1950	2/11/1950	2/18/1950	2/18/1950
	Collector:	Jurgens, K and E R	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown	Jurgens et al	Jurgens et al	Jurgens et al
	Locality:	Low-water bridge 0.5 miles N of Staples	Low-water bridge at Fentress	Below icehouse dam in San Marcos	Low-water bridge 0.5 miles S of Prairie Lea	Bridge 0.5 miles SE of Prairie Lea	US Hwy 90, 3 miles SW of Luling	Low-water bridge at Stairtown
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		13	-	-	1	3	-	-
<i>Gambusia affinis</i>		36	29	-	14	25	12	16
<i>Gambusia geiseri</i>		-	-	-	-	-	-	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		7	7	-	-	2	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Memidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	4	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	3	-	5	9	11	12
<i>Lepomis gulosus</i>		-	-	-	-	-	3	-
<i>Lepomis macrochirus</i>		-	-	1	-	1	3	-
<i>Lepomis megalotis</i>		-	-	-	4	2	33	1
<i>Lepomis microlophus</i>		-	-	-	-	-	-	-
<i>Lepomis mimatus</i>		-	4	37	-	18	-	-
<i>Lepomis punctatus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	11/11/1949	11/18/1949	12/19/1949 ^a	2/8/1950	2/11/1950	2/18/1950	2/18/1950
	Collector:	Jurgens, K. and E. R.	Jurgens and Brown	Jurgens and Brown	Jurgens and Brown	Jurgens et al.	Jurgens et al.	Jurgens et al.
	Locality:	Low-water bridge 0.5 miles N of Staples	Low-water bridge at Fentress	Below icehouse dam in San Marcos	Low-water bridge 0.5 miles S of Prairie Lea	Bridge 0.5 miles SE of Prairie Lea	US Hwy 90, 3 miles SW of Luling	Low-water bridge at Stairtown
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC
<i>Micropterus treculii</i>		2	3	1	5	3	1	2
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	1	-	-	-	-	-
<i>Percina carbonaria</i>		5	22	-	1	1	1	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		15	8	-	12	42	-	11
<i>Percina shumardi</i>		2	1	-	2	1	1	-
<i>Cichlasoma cyanoguttatum</i>		11	4	-	1	29	11	4
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		236	358	49	262	302	508	360

^aCollection not used in analyses

	Source:	2/19/1950	2/18/1950	2/26/1950 ^a	3/18/1950	3/25/1950 ^a	3/28/1950	11/26/1950
	Collector:	Jurgens et al	Jurgens and Farber	Jurgens and Hallum	Jurgens et al	Jurgens and Hubbs	Jurgens and Brown	Knapp
	Locality:	Hwy 80, 1 mile SE of Luling	Low-water bridge at Stairtown	SW of Gonzales near confluence	Bridge Palmetto Bend State Park	Below Spring Lake	Bridge on State Hwy 3	At San Marcos
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TCWC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		169	231	2	616	-	48	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	3	-	-	-	-	45
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marcomis</i>		5	18	-	242	-	1	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	1	-	-	-	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	16	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		12	27	-	20	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	1	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		51	53	8	11	-	4	-
<i>Carpodes carpio</i>		-	1	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	1	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	1	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	1	-	-	-

	Source:	2/19/1950	2/18/1950	2/26/1950 ^a	3/18/1950	3/25/1950 ^a	3/28/1950	11/26/1950
	Collector:	Jurgens et al	Jurgens and Farber	Jurgens and Hallum	Jurgens et al	Jurgens and Hubbs	Jurgens and Brown	Knapp
	Locality:	Hwy 80, 1 mile SE of Luling	Low-water bridge at Stairtown	SW of Gonzales near confluence	Bridge Palmetto Bend State Park	Below Spring Lake	Bridge on State Hwy 3	At San Marcos
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TCWC
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	3	-	5	-	-	-
<i>Gambusia affinis</i>		11	17	-	131	-	7	98
<i>Gambusia geiseri</i>		-	-	-	-	-	-	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	11	1	-	-	-	-
<i>Lepomis gulosus</i>		10	-	-	-	1	-	-
<i>Lepomis macrochirus</i>		3	-	5	1	8	1	-
<i>Lepomis megalotis</i>		20	10	10	2	-	2	-
<i>Lepomis microlophus</i>		-	-	-	1	3	-	-
<i>Lepomis miniatus</i>		-	-	-	-	-	1	-
<i>Lepomis punctatus</i>		-	-	-	-	-	-	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	1
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	2/19/1950	2/18/1950	2/26/1950 ^a	3/18/1950	3/25/1950 ^a	3/28/1950	11/26/1950
	Collector:	Jurgens et al.	Jurgens and Farber	Jurgens and Hallum	Jurgens et al.	Jurgens and Hubbs	Jurgens and Brown	Knapp
	Locality:	Hwy 80, 1 mile SE of Luling	Low-water bridge at Stairtown	SW of Gonzales near confluence	Bridge Palmetto Bend State Park	Below Spring Lake	Bridge on State Hwy 3	At San Marcos
	Source:	TNHC	TNHC	TNHC	TNHC	TNHC	TNHC	TCWC
<i>Micropterus treculi</i>		-	1	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	1	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	1	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	3	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		27	2	1	1	2	-	-
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		308	383	28	1031	16	80	144

^aCollection not used in analyses

	Source:	2/8/1952 ^a	4/12/1952	4/12/1952 ^a	4/12/1952	4/12/1952 ^a	4/12/1952	4/12/1952
	Collector:	Hubbs	Suttkus	Suttkus et al	Suttkus	Suttkus et al	Bailey and Party	Bailey and Party
	Locality:	Cotton gin, 1 mile E of San Marcos	At San Marcos	At San Marcos	At San Marcos	At San Marcos	Cotton Gin, 1 mile E of San Marcos	At San Marcos
	Source:	TNHC	Tulane	Tulane	Tulane	Tulane	UMMZ	UMMZ
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		4	-	-	-	-	-	1
<i>Cyprinella lutrensis X venusta</i>		-	1	-	-	9	-	-
<i>Cyprinella venusta</i>		2	-	11	-	-	2	1
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	5	-	-	-	-	6
<i>Macrhybopsis marconis</i>		-	-	4	-	-	-	-
<i>Notemigonus crysoleucas</i>		1	-	-	-	-	-	-
<i>Notropis amabilis</i>		13	24	4	-	-	3	113
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	2
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		4	-	-	5	-	1	6
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpionotus carpio</i>		-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	2
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	4	-	-	1	10	16
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	2/8/1952 ^a	4/12/1952	4/12/1952 ^a	4/12/1952	4/12/1952 ^a	4/12/1952	4/12/1952
	Collector:	Hubbs	Suttkus	Suttkus et al	Suttkus	Suttkus et al	Bailey and Party	Bailey and Party
	Locality:	Cotton gin, 1 mile E of San Marcos	At San Marcos	At San Marcos	At San Marcos	At San Marcos	Cotton Gin, 1 mile E of San Marcos	At San Marcos
	Source:	TNHC	Tulane	Tulane	Tulane	Tulane	UMMZ	UMMZ
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		1	-	3	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	4	-	-	5	8	13
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	-	-	-	-	-	7
<i>Gambusia geiseri</i>		-	-	3	63	-	28	51
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	6	3
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	1	6	7	-
<i>Lepomis auritus</i>		-	-	-	-	8	2	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	1	-
<i>Lepomis gulosus</i>		-	-	-	-	2	2	2
<i>Lepomis macrochirus</i>		-	-	-	-	6	7	3
<i>Lepomis megalotis</i>		-	-	-	-	-	-	-
<i>Lepomis microlophus</i>		1	-	-	-	-	6	-
<i>Lepomis mimatus</i>		-	-	-	-	6	-	-
<i>Lepomis punctatus</i>		-	14	-	-	-	15	99
<i>Lepomis sp</i>		-	-	-	-	-	1	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	2	3	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

Source:	2/8/1952^a	4/12/1952	4/12/1952^a	4/12/1952	4/12/1952^a	4/12/1952	4/12/1952
Collector:	Hubbs	Suttkus	Suttkus et al.	Suttkus	Suttkus et al.	Bailey and Party	Bailey and Party
Locality:	Cotton gin, 1 mile E of San Marcos	At San Marcos	At San Marcos	At San Marcos	At San Marcos	Cotton Gin, 1 mile E of San Marcos	At San Marcos
Source:	TNHC	Tulane	Tulane	Tulane	Tulane	UMMZ	UMMZ
<i>Micropterus treculi</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>	-	-	3	74	-	4	173
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	-	-	-	-	-
<i>Percina carbonaria</i>	-	-	3	-	-	1	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	6	-	14	-	-	19	-
<i>Percina shumardi</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	6	-	-	3	16	13
<i>Cichlasoma nigrofasciatum</i>	-	-	-	-	-	-	-
<i>Oreochromis aureus</i>	-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>	-	-	-	-	-	-	-
<i>Oreochromis sp</i>	-	-	-	-	-	-	-
Total	32	58	45	143	48	142	511

^aCollection not used in analyses

	Source:	4/12/1952	4/12/1952	5/3/1952	7/5/1953 ^a	11/27/1953	1/1/1954 ^a	1/1/1954
	Collector:	Lachner et al	Cross et al	Strawn and Pyburn	Strawn and Pettus	Strawn	Strawn	Strawn
	Locality:	Fish Hatchery off U S Route 81	One mile E of San Marcos	Belwo ice house dam	At Rio Vista Dam	Below Ice Plant Dam	Below bridge below Rio Vista Dam	Below Ice Plant Dam
	Source:	NMNH	KU	TNHC	TCWC	TCWC	TCWC	TCWC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		1	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	2	-	-	-	-	-
<i>Cyprinella venusta</i>		12	1	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	3	-	-	-	-
<i>Macrhybopsis marcomis</i>		2	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		11	1	-	-	-	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	2	-	-	-	-
<i>Notropis volucellus</i>		6	2	-	-	-	-	-
<i>Notropis sp</i>		1	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	3	-	-	1	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	3	-	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	4/12/1952	4/12/1952	5/3/1952	7/5/1953^a	11/27/1953	1/1/1954^a	1/1/1954
	Collector:	Lachner et al	Cross et al	Strawn and Pyburn	Strawn and Pettus	Strawn	Strawn	Strawn
	Locality:	Fish Hatchery off U S Route 81	One mile E of San Marcos	Belwo ice house dam	At Rio Vista Dam	Below Ice Plant Dam	Below bridge below Rio Vista Dam	Below Ice Plant Dam
	Source:	NMNH	KU	TNHC	TCWC	TCWC	TCWC	TCWC
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	2	1	-	-	-	-
<i>Ictalurus sp</i>		4	-	-	-	-	-	-
<i>Noturus gyrinus</i>		5	1	4	7	16	1	16
<i>Noturus nocturnus</i>		-	4	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	1	-	-	-	-	-
<i>Gambusia affinis</i>		-	7	2	-	-	-	-
<i>Gambusia geiseri</i>		15	-	33	7	-	-	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	47	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		44	5	-	-	-	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		6	4	-	-	-	-	-
<i>Lepomis auritus</i>		-	3	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	1	-	-	-	-	-
<i>Lepomis gulosus</i>		4	1	-	-	-	-	-
<i>Lepomis macrochirus</i>		33	14	-	-	1	-	-
<i>Lepomis megalotis</i>		-	3	-	-	-	-	-
<i>Lepomis microlophus</i>		-	1	-	-	-	-	-
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	12	-	-	-	-	-
<i>Lepomis sp</i>		13	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	1	-	-	-	-	-
<i>Micropterus sp X sp</i>		7	-	-	-	-	-	-

	Source:	4/12/1952	4/12/1952	5/3/1952	7/5/1953^a	11/27/1953	1/1/1954^a	1/1/1954
	Collector:	Lachner et al.	Cross et al.	Strawn and Pyburn	Strawn and Pettus	Strawn	Strawn	Strawn
	Locality:	Fish Hatchery off U.S. Route 81	One mile E of San Marcos	Belwo ice house dam	At Rio Vista Dam	Below Ice Plant Dam	Below bridge below Rio Vista Dam	Below Ice Plant Dam
	Source:	NMNH	KU	TNHC	TCWC	TCWC	TCWC	TCWC
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		14	15	6	13	69	-	79
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		2	1	1	-	-	-	-
<i>Percina carbonaria</i>		7	2	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristus</i>		57	5	-	18	-	8	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		5	9	-	-	-	-	1
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		249	148	55	45	86	10	96

^aCollection not used in analyses

	Source:	1/20/1954 ^a	10/23/1954	6/5/1955 ^a	1/24/1956	6/24/1956	9/5/1956 ^a	7/1/1957 ^a
	Collector:	Strawn and Hubbs	Strawn	Strawn and Hubbs	Strawn et al	Strawn et al	Strawn and Terry	Lowman et al
	Locality:	At Rio Vista Dam	Below Ice Plant Dam	Southland Ice Plant	Below Ice Plant Dam	Below Rio Vista Dam	At Thompson Island	San Marcos River at Loop 82 crossing
	Source:	TCWC	TCWC	TCWC	TCWC	TCWC	TCWC	TGFC 1958
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpodes carpio</i>		-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	1/20/1954 ^a	10/23/1954	6/5/1955 ^a	1/24/1956	6/24/1956	9/5/1956 ^a	7/1/1957 ^a
	Collector:	Strawn and Hubbs	Strawn	Strawn and Hubbs	Strawn et al	Strawn et al	Strawn and Terry	Lowman et al
	Locality:	At Rio Vista Dam	Below Ice Plant Dam	Southland Ice Plant	Below Ice Plant Dam	Below Rio Vista Dam	At Thompson Island	San Marcos River at Loop 82 crossing
	Source:	TCWC	TCWC	TCWC	TCWC	TCWC	TCWC	TGFC 1958
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	3	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		14	8	17	17	43	9	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	1	-	-	-	-	3
<i>Gambusia geiseri</i>		12	-	6	7	7	-	3
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		-	-	-	-	-	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	1	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	-	-
<i>Lepomis cyanellus</i>		-	2	1	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		-	-	-	1	-	-	-
<i>Lepomis megalotis</i>		-	1	-	4	-	-	-
<i>Lepomis microlophus</i>		-	-	-	-	-	-	1
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	-	-	-	-	8
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	3
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	1/20/1954 ^a	10/23/1954	6/5/1955 ^a	1/24/1956	6/24/1956	9/5/1956 ^a	7/1/1957 ^a
	Collector:	Strawn and Hubbs	Strawn	Strawn and Hubbs	Strawn et al.	Strawn et al.	Strawn and Terry	Lowman et al.
	Locality:	At Rio Vista Dam	Below Ice Plant Dam	Southland Ice Plant	Below Ice Plant Dam	Below Rio Vista Dam	At Thompson Island	San Marcos River at Loop 82 crossing
	Source:	TCWC	TCWC	TCWC	TCWC	TCWC	TCWC	TGFC 1958
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	70	65	55	165	1	1
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		12	-	-	-	-	3	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	4	2	-
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		38	83	89	84	219	18	19

^aCollection not used in analyses

	Source:	7/1/1957	7/1/1957	7/1/1957	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957
	Collector:	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al
	Locality:	San Marcos, W Hutchenson Street	San Marcos, Cheatam Street	San Marcos, Thompson Island	San Marcos, Westerfield Road	NW of Martindale, TX	FM 1979 S of Martindale	1 7 miles S of FM 1979 crossing
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	5	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	4	-	-	6
<i>Campostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		3	-	6	9	14	-	16
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	3	-	-
<i>Cyprinella venusta</i>		21	-	14	9	94	7	35
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	1	1	-	2	-	-
<i>Macrhybopsis marcomis</i>		-	-	1	2	16	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		15	8	-	-	2	-	7
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	3	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	2	-	3
<i>Carpionotus carpio</i>		-	-	-	1	-	-	5
<i>Ichthyophaga bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	2	-	-	-
<i>Astyanax mexicanus</i>		5	2	-	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	6	1	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	7/1/1957	7/1/1957	7/1/1957	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957
	Collector:	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al
	Locality:	San Marcos, W Hutchenson Street	San Marcos, Cheatam Street	San Marcos, Thompson Island	San Marcos, Westerfield Road	NW of Martindale, TX	FM 1979 S of Martindale	1 7 miles S of FM 1979 crossing
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	6	2	1	12	1	2
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	1	-	-	-
<i>Gambusia affinis</i>		2	19	6	3	30	6	2
<i>Gambusia geiseri</i>		-	22	1	-	-	1	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		14	2	33	-	1	3	6
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	5	-	1	2	-	3
<i>Lepomis cyanellus</i>		1	-	-	-	5	1	-
<i>Lepomis gulosus</i>		-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>		10	-	1	-	2	-	-
<i>Lepomis megalotis</i>		-	-	-	-	1	-	-
<i>Lepomis microlophus</i>		-	1	-	-	2	-	2
<i>Lepomis minimus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		1	-	-	-	-	1	-
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		4	1	1	1	1	1	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	7/1/1957	7/1/1957	7/1/1957	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957
	Collector:	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.
	Locality:	San Marcos, W Hutchenson Street	San Marcos, Cheatam Street	San Marcos, Thompson Island	San Marcos, Westerfield Road	NW of Martindale, TX	FM 1979 S of Martindale	1.7 miles S of FM 1979 crossing
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958
<i>Micropterus treculii</i>		-	-	-	-	1	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		2	5	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristus</i>		3	5	2	1	2	1	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		4	2	1	1	81	7	1
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		85	79	72	41	279	30	88

^aCollection not used in analyses

	Source:	7/1/1957 ^a	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957 ^a	8/14/1960	8/14/1960
	Collector:	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Hubbs and Drewry	Collette
	Locality:	R P Lowman Farm at Staples, TX	FM 964 crossing, N of Fentress, TX	First crossing SE of Prairie Lea, TX	Hwy 90 crossing SW of Luling, TX	Hwy 90, W of Gonzales	Drainage ditch at fish hatchery	4 miles E, 0.5 miles S of San Marcos
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TNHC	NMNH
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		18	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		6	-	-	-	17	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	19	35	6	7	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	18	22	6	2	-	6
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	10	32	5	-	-	1
<i>Notemigonus crysoleucas</i>		-	-	-	-	2	2	-
<i>Notropis amabilis</i>		-	-	-	-	-	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	3	-	-	-
<i>Pimephales vigilax</i>		-	-	13	14	2	-	-
<i>Carpiodes carpio</i>		1	-	-	-	1	-	-
<i>Ictiobus bubalus</i>		1	-	-	-	2	-	-
<i>Moxostoma congestum</i>		2	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	1	1
<i>Ameiurus melas</i>		-	-	-	-	-	14	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	6
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	7/1/1957 ^a	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957 ^a	8/14/1960	8/14/1960
	Collector:	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Lowman et al	Hubbs and Drewry	Collette
	Locality:	R P Lowman Farm at Staples, TX	FM 964 crossing, N of Fentress, TX	First crossing SE of Prairie Lea, TX	Hwy 90 crossing SW of Luling, TX	Hwy 90, W of Gonzales	Drainage ditch at fish hatchery	4 miles E, 0 5 miles S of San Marcos
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TNHC	NMNH
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		8	-	3	-	1	1	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	3
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	-	2	5	-	79	-
<i>Gambusia geiseri</i>		-	-	-	-	-	-	11
<i>Gambusia georgei</i>		-	-	-	-	-	4	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	114	-
<i>Poecilia latipinna</i>		-	-	1	-	-	54	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	-	-	-	-
<i>Lepomis auritus</i>		-	-	3	-	-	-	-
<i>Lepomis cyanellus</i>		-	-	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	-	-	1	-
<i>Lepomis macrochirus</i>		-	-	1	-	1	22	-
<i>Lepomis megalotis</i>		-	-	-	-	-	-	1
<i>Lepomis microlophus</i>		-	-	-	-	1	-	7
<i>Lepomis minimus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	-	-	-	-	11
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	1	12
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	7/1/1957 ^a	7/1/1957 ^a	7/1/1957	7/1/1957 ^a	7/1/1957 ^a	8/14/1960	8/14/1960
	Collector:	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.	Lowman et al.	Hubbs and Drewry	Collette
	Locality:	R. P. Lowman Farm at Staples, TX	FM 964 crossing, N of Fentress, TX	First crossing SE of Prairie Lea, TX	Hwy 90 crossing SW of Luling, TX	Hwy 90, W of Gonzales	Drainage ditch at fish hatchery	4 miles E, 0.5 miles S of San Marcos
	Source:	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TGFC 1958	TNHC	NMNH
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	-	-	-	21
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	-	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	-	-	1	3	6
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		36	47	112	39	37	296	86

^aCollection not used in analyses

	Source:	9/17/1960	9/18/1960	11/12/1960 ^a	11/14/1960 ^a	12/3/1960 ^a	4/1/1961	4/1/1961
	Collector:	Collette	Hubbs et al	Danzeiser	Omundson	Hubbs and Laritz	Suttikus and Collette	Cross et al
	Locality:	Hwy 90 E of Segun	Hatchery and Thompson Island	Two miles from headwaters	At San Marcos	At Thompson Island	At San Marcos	San Marcos City Park
	Source:	NMNH	TNHC	TCWC	TCWC	TNHC	Tulane	KU
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		4	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		8	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	1	5	6
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	4	-
<i>Notropis amabilis</i>		-	-	2	-	-	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	-	-
<i>Notropis sp</i>		1	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		33	-	-	-	-	-	-
<i>Carpodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	3	-
<i>Amenurus melas</i>		-	-	-	-	-	-	-
<i>Amenurus natalis</i>		-	-	-	-	1	5	1
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	9/17/1960	9/18/1960	11/12/1960 ^a	11/14/1960 ^a	12/3/1960 ^a	4/1/1961	4/1/1961
	Collector:	Collette	Hubbs et al	Danzeiser	Omundson	Hubbs and Lartz	Suttkus and Collette	Cross et al
	Locality:	Hwy 90 E of Seguin	Hatchery and Thompson Island	Two miles from headwaters	At San Marcos	At Thompson Island	At San Marcos	San Marcos City Park
	Source:	NMNH	TNHC	TCWC	TCWC	TNHC	Tulane	KU
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	2	-	-	-	-	-
<i>Ictalurus sp</i>		1	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	1
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		32	-	-	-	-	-	-
<i>Gambusia affinis</i>		11	2	2	-	9	-	54
<i>Gambusia geiseri</i>		-	1	-	-	-	88	129
<i>Gambusia georgei</i>		-	39	-	-	-	-	-
<i>Gambusia sp</i>		50	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	35	-	-	8	-	-
<i>Poecilia latipinna</i>		-	17	-	1	16	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	2	-	-	-
<i>Lepomis auritus</i>		-	-	-	-	-	4	-
<i>Lepomis cyanellus</i>		3	8	-	-	1	-	-
<i>Lepomis gulosus</i>		-	-	-	-	-	-	1
<i>Lepomis macrochirus</i>		-	1	1	-	1	5	-
<i>Lepomis megalotis</i>		1	-	-	-	-	-	-
<i>Lepomis microlophus</i>		-	-	-	-	2	11	-
<i>Lepomis mimatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	-	-	4	19	5
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	38	1	-	-	4	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

Source:	9/17/1960	9/18/1960	11/12/1960^a	11/14/1960^a	12/3/1960^a	4/1/1961	4/1/1961
Collector:	Collette	Hubbs et al.	Danzeiser	Omundson	Hubbs and Laritz	Suttkus and Collette	Cross et al.
Locality:	Hwy 90 E of Seguin	Hatchery and Thompson Island	Two miles from headwaters	At San Marcos	At Thompson Island	At San Marcos	San Marcos City Park
Source:	NMNH	TNHC	TCWC	TCWC	TNHC	Tulane	KU
<i>Micropterus treculi</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>	-	-	-	-	-	77	31
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	2	-	-	-	-	-	-
<i>Percina carbonaria</i>	1	-	-	1	-	-	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	-	-	-	2	-	-	-
<i>Percina shumardi</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	16	3	-	2	2	11	1
<i>Cichlasoma nigrofasciatum</i>	-	-	-	-	-	-	-
<i>Oreochromis aureus</i>	-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>	-	-	-	-	-	-	-
<i>Oreochromis sp.</i>	-	-	-	-	-	-	-
Total	163	146	6	8	45	236	229

^aCollection not used in analyses

	Source:	6/24/1961	7/22/1961	8/25/1961	10/10/1963 ^a	10/30/1964 ^a	3/14/1976	3/14/1976
	Collector:	Hubbs et al	Hubbs et al	Hubbs and Drewery	Hubbs and Lartz	Hood	Cross et al	Cross et al
	Locality:	San Marcos, Thompson Island	San Marcos, Thompson Island	San Marcos, Thompson Island	At Old Town	300 yards E of I-35 bridge	At Martindale	FM 20 at Fentress
	Source:	TNHC	TNHC	TNHC	TNHC	TCWC	KU	KU
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	1	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	73	109
<i>Cyprinella venusta</i>		3	4	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	-	-	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	1	-	-	-
<i>Notropis amabilis</i>		8	19	-	-	-	30	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	105	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpionodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	13	-
<i>Astyanax mexicanus</i>		-	-	-	-	1	3	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	6/24/1961	7/22/1961	8/25/1961	10/10/1963 ^a	10/30/1964 ^a	3/14/1976	3/14/1976
	Collector:	Hubbs et al	Hubbs et al	Hubbs and Drewery	Hubbs and Laritz	Hood	Cross et al	Cross et al
	Locality:	San Marcos, Thompson Island	San Marcos, Thompson Island	San Marcos, Thompson Island	At Old Town	300 yards E of I-35 bridge	At Martindale	FM 20 at Fentress
	Source:	TNHC	TNHC	TNHC	TNHC	TCWC	KU	KU
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	1	-	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	5	-
<i>Gambusia affinis</i>	113	-	-	-	1	-	-	29
<i>Gambusia geiseri</i>	91	189	101	-	-	-	-	-
<i>Gambusia georgei</i>	8	14	5	-	-	-	-	-
<i>Gambusia sp</i>	-	-	-	-	-	-	-	-
<i>Poecilia formosa</i>	56	42	42	25	1	-	-	-
<i>Poecilia latipinna</i>	40	32	20	24	-	-	-	-
<i>Poecilia sp</i>	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	1	-	-
<i>Lepomis auritus</i>	-	-	-	-	-	1	-	-
<i>Lepomis cyanellus</i>	-	-	-	1	-	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	-	-	-	-	-	-
<i>Lepomis megalotis</i>	-	1	-	-	-	-	10	-
<i>Lepomis microlophus</i>	1	-	-	-	-	-	-	-
<i>Lepomis mimatus</i>	-	-	-	-	-	-	-	-
<i>Lepomis punctatus</i>	-	-	1	-	-	1	4	-
<i>Lepomis sp</i>	-	-	-	-	-	-	1	-
<i>Micropterus dolomieu</i>	-	-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>	-	-	-	-	-	-	-	-
<i>Micropterus salmoides</i>	7	5	-	1	-	-	-	-
<i>Micropterus sp X sp</i>	-	-	-	-	-	-	-	-

Source:	6/24/1961	7/22/1961	8/25/1961	10/10/1963^a	10/30/1964^a	3/14/1976	3/14/1976
Collector:	Hubbs et al.	Hubbs et al.	Hubbs and Drewery	Hubbs and Laritz	Hood	Cross et al.	Cross et al.
Locality:	San Marcos, Thompson Island	San Marcos, Thompson Island	San Marcos, Thompson Island	At Old Town	300 yards E of I-35 bridge	At Martindale	FM 20 at Fentress
Source:	TNHC	TNHC	TNHC	TNHC	TCWC	KU	KU
<i>Micropterus treculii</i>	-	-	-	-	-	1	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>	3	3	11	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	-	1	-	5	-
<i>Percina carbonaria</i>	-	-	-	-	-	-	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	-	-	-	-	-	12	19
<i>Percina shumardi</i>	-	-	-	-	-	-	1
<i>Cichlasoma cyanoguttatum</i>	2	25	41	1	-	3	-
<i>Cichlasoma nigrofasciatum</i>	-	-	-	-	-	-	-
<i>Oreochromis aureus</i>	-	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>	-	-	-	-	-	-	-
<i>Oreochromis sp</i>	-	-	-	-	-	-	-
Total	332	335	222	55	5	265	158

^aCollection not used in analyses

	Source:	10/1/1977 ^a	8/1/1979	1/1/1983	9/1/1984 ^a	9/1/1984 ^a	9/1/1984 ^a	6/4/1984 ^a
	Collector:	McEachran et al	Underwood	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
	Locality:	San Marcos, Thompson's Island	Upper San Marcos River	Hays County	San Marcos, Cheatum Street	San Marcos, Thompson's Island	San Marcos, westerfield Crossing	Spring Lake Falls, San Marcos
	Source:	TCWC	Underwood 1981	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334
<i>Lepisosteus oculatus</i>	-	-	1	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	-	-	-	3	-	-	5	-
<i>Carassius auratus</i>	-	-	-	4	-	5	-	-
<i>Cyprinella lutrensis</i>	-	-	-	7	-	4	-	-
<i>Cyprinella lutrensis X venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	-	15	12	-	-	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-	-
<i>Dionda nigrotaemata</i>	1	42	16	-	-	-	-	-
<i>Macrhybopsis marconis</i>	-	-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>	-	-	3	-	-	-	-	-
<i>Notropis amabilis</i>	-	-	17	-	-	12	22	-
<i>Hybopsis amnis</i>	-	-	-	-	-	-	-	-
<i>Notropis bethlemi</i>	-	-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>	-	-	-	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	13	-	-	-	-	-
<i>Notropis volucellus</i>	-	-	8	-	-	5	13	-
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>	-	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-	-
<i>Carpodes carpio</i>	-	-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	2	-	-	-	-	-	-
<i>Astyanax mexicanus</i>	-	233	1	4	2	-	-	3
<i>Ameiurus melas</i>	-	1	-	-	-	-	-	-
<i>Ameiurus natalis</i>	-	3	3	2	1	-	-	1
<i>Ictalurus furcatus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-	-

	Source:	10/1/1977^a	8/1/1979	1/1/1983	9/1/1984^a	9/1/1984^a	9/1/1984^a	6/4/1984^a
	Collector:	McEachran et al	Underwood	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
	Locality:	San Marcos, Thompson's Island	Upper San Marcos River	Hays County	San Marcos, Cheatum Street	San Marcos, Thompson's Island	San Marcos, Westerfield Crossing	Spring Lake Falls, San Marcos
	Source:	TCWC	Underwood 1981	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334
<i>Ictalurus nebulosus</i>	-	-	1	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus sp</i>	-	-	-	-	-	-	-	-
<i>Noturus gyrinus</i>	-	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-	-
<i>Hypostomus sp</i>	-	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	-	-	-	-	-	-	-
<i>Gambusia affinis</i>	-	-	-	12	-	-	-	-
<i>Gambusia geiseri</i>	-	-	-	8	-	-	-	-
<i>Gambusia georgei</i>	-	-	-	-	-	-	-	-
<i>Gambusia sp</i>	-	-	-	-	-	-	-	-
<i>Poecilia formosa</i>	1	-	-	2	1	-	3	-
<i>Poecilia latipinna</i>	-	-	1	2	2	-	1	-
<i>Poecilia sp</i>	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	47	3	4	-	-	5
<i>Lepomis auritus</i>	-	-	126	10	-	-	-	7
<i>Lepomis cyanellus</i>	-	-	2	10	-	-	-	-
<i>Lepomis gulosus</i>	-	-	48	-	-	-	-	-
<i>Lepomis macrochirus</i>	-	-	329	9	-	-	-	5
<i>Lepomis megalotis</i>	-	-	-	-	-	-	-	-
<i>Lepomis microlophus</i>	-	-	107	1	-	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-	-
<i>Lepomis punctatus</i>	8	-	653	4	9	-	-	7
<i>Lepomis sp</i>	-	-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>	-	-	-	-	-	-	-	3
<i>Micropterus punctulatus</i>	-	-	5	-	-	-	-	-
<i>Micropterus salmoides</i>	-	-	140	7	-	-	-	-
<i>Micropterus sp X sp</i>	-	-	-	-	-	-	-	-

	Source:	10/1/1977^a	8/1/1979	1/1/1983	9/1/1984^a	9/1/1984^a	9/1/1984^a	6/4/1984^a
	Collector:	McEachran et al.	Underwood	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
	Locality:	San Marcos, Thompson's Island	Upper San Marcos River	Hays County	San Marcos, Cheatum Street	San Marcos, Thompson's Island	San Marcos, westerfield Crossing	Spring Lake Falls, San Marcos
	Source:	TCWC	Underwood 1981	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	2	2	-	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	1	-	-	-	-
<i>Percina apristis</i>		-	-	2	-	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	70	1	-	-	-	2
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		2	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	8	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		12	1836	161	22	29	44	33

^aCollection not used in analyses

	Source:	6/4/1984 ^a	6/4/1984	6/4/1984	1/1/1985 ^a	1/1/1985 ^a	1/1/1985 ^a	1/1/1986 ^a
	Collector:	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
	Locality:	Rio Vista Dam, San Marcos	San Marcos, Thompson's Island	Old Westerfield Crossing	San Marcos, Cheatum Street	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Cheatham Street
	Source:	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	-	-	5	-	-	4	-	-
<i>Carassius auratus</i>	-	-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>	-	7	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	15	5	-	-	21	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>	3	-	-	3	-	-	2	-
<i>Macrhybopsis marconis</i>	-	-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>	-	-	-	-	-	-	-	-
<i>Notropis amabilis</i>	-	4	11	-	5	8	-	-
<i>Hybopsis amnis</i>	-	-	-	-	-	-	-	-
<i>Notropis bethlemi</i>	-	-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>	-	-	-	-	-	-	-	-
<i>Notropis stramineus</i>	-	-	-	-	-	-	-	-
<i>Notropis volucellus</i>	-	13	6	-	-	6	-	-
<i>Notropis sp</i>	-	-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>	-	-	-	-	-	-	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	-	-	-	-	-	-
<i>Carpodes carpio</i>	-	-	-	-	-	-	-	-
<i>Ichthys bubalus</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	2	-	-	-	-	-
<i>Astyanax mexicanus</i>	4	3	-	4	3	-	4	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	1	-	-	-	1	-	-	-
<i>Ictalurus furcatus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-	-

	Source:	6/4/1984 ^a	6/4/1984	6/4/1984	1/1/1985 ^a	1/1/1985 ^a	1/1/1985 ^a	1/1/1986 ^a
	Collector:	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
	Locality:	Rio Vista Dam, San Marcos	San Marcos, Thompson's Island	Old Westerfield Crossing	San Marcos, Cheatum Street	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Cheatham Street
	Source:	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334	Permit No 334
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	2	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	-	-	-	5	-	-
<i>Gambusia geiseri</i>		13	13	13	10	15	5	8
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		1	-	3	1	-	2	1
<i>Poecilia latipinna</i>		-	-	2	3	-	1	3
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	-	2	-	-	4
<i>Lepomis auritus</i>		-	-	-	1	-	3	-
<i>Lepomis cyanellus</i>		-	1	-	-	-	-	-
<i>Lepomis gulosus</i>		-	-	-	-	1	-	-
<i>Lepomis macrochirus</i>		-	5	-	-	-	-	-
<i>Lepomis megalotis</i>		-	-	-	-	-	-	-
<i>Lepomis microlophus</i>		-	2	-	-	-	-	-
<i>Lepomis mimatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	-	9	-	-	6
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	1	-	-	-	-
<i>Micropterus salmoides</i>		-	-	-	-	-	-	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

Source:	6/4/1984^a	6/4/1984	6/4/1984	1/1/1985^a	1/1/1985^a	1/1/1985^a	1/1/1986^a
Collector:	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside	Whiteside
Locality:	Rio Vista Dam, San Marcos	San Marcos, Thompson's Island	Old Westerfield Crossing	San Marcos, Cheatum Street	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Cheatham Street
Source:	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334	Permit No. 334
<i>Micropterus treculii</i>	-	-	-	-	-	-	-
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>	-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	-	-	-	-	-	-	-
<i>Percina carbonaria</i>	-	1	-	-	-	-	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristis</i>	-	3	3	-	3	-	-
<i>Percina shumardi</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	-	-	-	-	2	-	-
<i>Cichlasoma nigrofasciatum</i>	-	-	-	-	-	-	-
<i>Oreochromis aureus</i>	-	-	-	-	1	-	-
<i>Oreochromis mossambicus</i>	-	-	-	-	-	-	-
<i>Oreochromis sp.</i>	-	-	-	-	-	-	-
Total	22	67	53	33	36	50	28

^aCollection not used in analyses

	Source:	1/1/1986 ^a	1/1/1986	2/7/1986	1/1/1988	1/1/1989	6/1/1990	1/1/1991
	Collector:	Whiteside	Whiteside	Hubbs et al	Whiteside	Whiteside	Edwards	Edwards
	Locality:	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Thompson Island	Hays County	Hays County	Hays Country	Hays Country
	Source:	Permit No 334	Permit No 334	TNHC	Permit No 334	Permit No 334	Permit No SPR-0790- 188	Permit No SPR-0790- 188
<i>Lepisosteus oculatus</i>	-	-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>	-	-	-	-	-	-	-	-
<i>Anguilla rostrata</i>	-	-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>	-	-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>	-	5	-	16	5	11	-	-
<i>Carassius auratus</i>	5	-	-	-	-	4	-	-
<i>Cyprinella lutrensis</i>	-	-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>	-	-	-	-	-	-	-	-
<i>Cyprinella venusta</i>	-	21	101	5	17	29	-	-
<i>Cyprinus carpio</i>	-	-	-	-	-	400	-	-
<i>Dionda nigrotaeniata</i>	-	-	-	19	5	-	-	-
<i>Macrhybopsis marcomis</i>	-	-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>	-	-	3	-	-	-	-	-
<i>Notropis amabilis</i>	12	22	8	7	46	480	-	-
<i>Hybopsis amnis</i>	-	-	-	-	-	-	-	-
<i>Notropis buechanani</i>	-	-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>	-	-	-	-	-	191	-	-
<i>Notropis stramineus</i>	-	-	-	-	11	72	-	-
<i>Notropis volucellus</i>	-	4	-	1	17	63	-	-
<i>Notropis sp</i>	-	-	7	-	-	-	-	-
<i>Opsopoeodus emiliae</i>	-	-	-	-	-	3	-	-
<i>Pimephales promelas</i>	-	-	-	-	-	-	-	-
<i>Pimephales vigilax</i>	-	-	1	-	-	36	-	-
<i>Carpionodes carpio</i>	-	-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>	-	-	-	-	-	-	-	-
<i>Moxostoma congestum</i>	-	-	-	2	-	-	-	-
<i>Astyanax mexicanus</i>	2	-	22	34	27	7	-	-
<i>Ameiurus melas</i>	-	-	-	-	-	-	-	-
<i>Ameiurus natalis</i>	1	-	2	2	1	10	-	-
<i>Ictalurus furcatus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus lupus</i>	-	-	-	-	-	-	-	-

	Source:	1/1/1986^a	1/1/1986	2/7/1986	1/1/1988	1/1/1989	6/1/1990	1/1/1991
	Collector:	Whiteside	Whiteside	Hubbs et al	Whiteside	Whiteside	Edwards	Edwards
	Locality:	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Thompson Island	Hays County	Hays County	Hays Country	Hays Country
	Source:	Permit No 334	Permit No 334	TNHC	Permit No 334	Permit No 334	Permit No SPR-0790- 188	Permit No SPR-0790- 188
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	1	-	-	21	-
<i>Gambusia affinis</i>		5	-	15	29	33	690	74
<i>Gambusia geiseri</i>		10	5	69	42	37	15450	386
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	4	28	3	8	133	3
<i>Poecilia latipinna</i>		-	3	3	13	17	202	87
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	3	8	2	23	2
<i>Lepomis auritus</i>		-	-	8	6	-	51	-
<i>Lepomis cyanellus</i>		-	-	4	-	-	4	-
<i>Lepomis gulosus</i>		-	-	2	-	1	4	-
<i>Lepomis macrochirus</i>		-	-	10	10	9	65	1
<i>Lepomis megalotis</i>		-	-	-	-	1	14	-
<i>Lepomis microlophus</i>		-	-	5	-	-	7	-
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		-	-	2	53	15	57	5
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	1	3	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	-	2	9	1	37	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	1/1/1986^a	1/1/1986	2/7/1986	1/1/1988	1/1/1989	6/1/1990	1/1/1991
	Collector:	Whiteside	Whiteside	Hubbs et al.	Whiteside	Whiteside	Edwards	Edwards
	Locality:	San Marcos, Thompson's Island	Westerfield Crossing	San Marcos, Thompson Island	Hays County	Hays County	Hays Country	Hays Country
	Source:	Permit No. 334	Permit No. 334	TNHC	Permit No. 334	Permit No. 334	Permit No. SPR-0790- 188	Permit No. SPR-0790- 188
<i>Micropterus treculii</i>		-	-	-	-	-	60	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	12	-	-	24
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	14	3	2	2	-
<i>Percina carbonaria</i>		-	-	-	1	-	-	-
<i>Percina macrolepida</i>		-	-	-	1	-	-	-
<i>Percina apristus</i>		-	-	15	14	1	15	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		-	-	10	2	5	31	-
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	5	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	6	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		35	64	335	292	267	18181	582

^aCollection not used in analyses

	Source:	1/1/1992	1/1/1992	6/9/1992	6/17/1992 ^a	7/8/1992 ^a	7/15/1992	7/28/1992
	Collector:	Edwards	Whiteside	Kelsey and Labay	Kelsey and Hood	Kelsey and Brown	Kelsey et al	Keslsy and Larralde
	Locality:	Hays Country	Hays Country	San Marcos, Rio Vista Dam	Thompson Island lower Channel	Upstream of Cummings Dam	Downstream of Cummings Dam	Below Martindale
	Source:	Permit No SPR-0790-188	Permit No SPR-0990-277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	1	3	-
<i>Campostoma anomalum</i>		-	1	-	-	-	-	6
<i>Carassius auratus</i>		3	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		33	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		16	-	2	-	-	5	2
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaemata</i>		-	6	2	1	-	4	-
<i>Macrhybopsis marcomis</i>		6	-	-	-	-	3	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	6	-
<i>Notropis amabilis</i>		112	-	26	-	1	18	2
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buechanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	15	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		1	-	-	-	-	144	17
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpionodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	-	-	-	1	4
<i>Astyanax mexicanus</i>		22	-	4	1	-	-	-
<i>Ameiurus melas</i>		-	-	1	1	-	-	-
<i>Ameiurus natalis</i>		1	-	3	-	-	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

Source:	1/1/1992	1/1/1992	6/9/1992	6/17/1992 ^a	7/8/1992 ^a	7/15/1992	7/28/1992
Collector:	Edwards	Whiteside	Kelsey and Labay	Kelsey and Hood	Kelsey and Brown	Kelsey et al	Keslsy and Larralde
Locality:	Hays Country	Hays Country	San Marcos, Rio Vista Dam	Thompson Island lower Channel	Upstream of Cummings Dam	Downstream of Cummings Dam	Below Martindale
Source:	Permit No SPR-0790-188	Permit No SPR-0990-277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Ictalurus nebulosus</i>	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	-	-	-	-	-	6	2
<i>Ictalurus sp</i>	-	-	-	-	-	-	-
<i>Noturus gyrinus</i>	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-
<i>Hypostomus sp</i>	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	2	-	-	-	-	1
<i>Gambusia affinis</i>	75	8	55	12	-	1	-
<i>Gambusia geiseri</i>	555	45	4	4	-	-	-
<i>Gambusia georgei</i>	-	-	-	-	-	-	-
<i>Gambusia sp</i>	-	-	-	-	-	-	-
<i>Poecilia formosa</i>	12	-	-	-	-	-	-
<i>Poecilia latipinna</i>	60	20	-	-	-	-	-
<i>Poecilia sp</i>	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	1	3	1	-	-	-	-
<i>Lepomis auritus</i>	3	31	14	4	9	60	17
<i>Lepomis cyanellus</i>	1	2	-	1	-	4	2
<i>Lepomis gulosus</i>	1	-	1	2	-	1	1
<i>Lepomis macrochirus</i>	6	10	10	-	7	22	9
<i>Lepomis megalotis</i>	3	-	-	-	-	-	2
<i>Lepomis microlophus</i>	1	-	-	-	-	4	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-
<i>Lepomis punctatus</i>	10	23	5	11	-	3	-
<i>Lepomis sp</i>	-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>	-	-	-	-	2	2	1
<i>Micropterus punctulatus</i>	-	-	-	-	-	1	3
<i>Micropterus salmoides</i>	8	-	6	7	-	4	1
<i>Micropterus sp. X sp</i>	-	-	-	-	-	-	-

	Source:	1/1/1992	1/1/1992	6/9/1992	6/17/1992^a	7/8/1992^a	7/15/1992	7/28/1992
	Collector:	Edwards	Whiteside	Kelsey and Labay	Kelsey and Hood	Kelsey and Brown	Kelsey et al.	Keslsey and Larralde
	Locality:	Hays Country	Hays Country	San Marcos, Rio Vista Dam	Thompson Island lower Channel	Upstream of Cummings Dam	Downstream of Cummings Dam	Below Martindale
	Source:	Permit No SPR-0790-188	Permit No SPR-0990-277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Micropterus treculii</i>		-	-	-	-	-	2	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	4	7	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	9	-
<i>Percina carbonaria</i>		-	-	-	-	-	2	-
<i>Percina macrolepida</i>		-	-	-	-	-	2	-
<i>Percina apristus</i>		-	-	-	-	-	30	13
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		14	3	2	1	3	6	1
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		12	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		956	173	143	45	23	343	84

^aCollection not used in analyses

	Source:	7/30/1992 ^a	8/4/1992	8/6/1992 ^a	8/7/1992	8/25/1992	5/17/1993	5/25/1993
	Collector:	Kelsey and Brown	Kelsey and Brown	Kelsey and Brown	Labay and Kelsey	Kelsey and Brown	Kelsey and Brown	Kelsey et al
	Locality:	Above Cummings Dam	Below Staples Dam	Between Fentress and Prairie Lea	Just downstream of Prairie Lea	Between Prairie Lea and Stairtown	Above Gaudalupe River confluence	Upstream of Rio Vista Dam
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	2	-
<i>Anguilla rostrata</i>		-	-	-	1	-	-	-
<i>Dorosoma cepedianum</i>		-	1	1	5	-	25	-
<i>Camptostoma anomalum</i>		-	-	3	-	3	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	13	10	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		1	5	-	4	2	1	-
<i>Cyprinus carpio</i>		-	-	-	-	-	4	-
<i>Dionda nigrotaeniata</i>		-	6	2	8	2	-	1
<i>Macrhybopsis marconis</i>		-	4	-	8	-	-	-
<i>Notemigonus crysoleucas</i>		1	-	-	6	1	-	-
<i>Notropis amabilis</i>		1	18	1	2	2	-	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	3	5	2	11	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	3	2	5	-
<i>Carpionotus carpio</i>		-	-	-	-	-	-	-
<i>Ictalurus bubalus</i>		-	-	-	-	-	7	-
<i>Moxostoma congestum</i>		2	7	-	5	-	-	-
<i>Astyanax mexicanus</i>		-	-	-	-	-	-	1
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	-	-	-	1
<i>Ictalurus furcatus</i>		-	-	-	-	-	1	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	7/30/1992^a	8/4/1992	8/6/1992^a	8/7/1992	8/25/1992	5/17/1993	5/25/1993
	Collector:	Kelsey and Brown	Kelsey and Brown	Kelsey and Brown	Labay and Kelsey	Kelsey and Brown	Kelsey and Brown	Kelsey et al
	Locality:	Above Cummings Dam	Below Staples Dam	Between Fentress and Prairie Lea	Just downstream of Prairie Lea	Between Praire Lea and Stairtown	Above Gaudalupe River confluence	Upstream of Rio Vista Dam
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Ictalurus nebulosus</i>	-	-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>	1	3	-	6	4	3	-	-
<i>Ictalurus sp</i>	-	-	-	-	-	-	-	-
<i>Noturus gyrinus</i>	-	-	-	-	-	-	-	-
<i>Noturus nocturnus</i>	-	-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>	-	-	-	-	-	-	-	-
<i>Hypostomus sp</i>	-	-	-	-	-	-	-	-
<i>Fundulus notatus</i>	-	-	-	-	-	-	-	2
<i>Gambusia affinis</i>	-	-	-	-	-	-	-	10
<i>Gambusia geiseri</i>	-	-	-	-	3	-	-	9
<i>Gambusia georgei</i>	-	-	-	-	-	-	-	-
<i>Gambusia sp</i>	-	-	-	-	-	-	-	-
<i>Poecilia formosa</i>	-	-	-	-	-	-	-	-
<i>Poecilia latipinna</i>	-	-	-	-	-	-	-	-
<i>Poecilia sp</i>	-	-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>	-	-	-	-	-	-	-	-
<i>Menidia beryllina</i>	-	-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>	-	-	-	-	-	-	-	3
<i>Lepomis auritus</i>	6	-	13	4	6	-	-	23
<i>Lepomis cyanellus</i>	1	8	4	-	17	-	-	-
<i>Lepomis gulosus</i>	-	-	-	-	1	-	-	-
<i>Lepomis macrochirus</i>	4	12	2	4	6	11	-	-
<i>Lepomis megalotis</i>	1	24	3	12	3	29	-	-
<i>Lepomis microlophus</i>	1	4	1	1	1	-	-	-
<i>Lepomis miniatus</i>	-	-	-	-	-	-	-	-
<i>Lepomis punctatus</i>	-	2	-	-	1	-	-	19
<i>Lepomis sp</i>	-	-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>	1	-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>	1	1	1	-	1	-	-	-
<i>Micropterus salmoides</i>	-	-	2	1	-	-	-	7
<i>Micropterus sp X sp</i>	-	-	-	-	-	-	-	-

	Source:	7/30/1992^a	8/4/1992	8/6/1992^a	8/7/1992	8/25/1992	5/17/1993	5/25/1993
	Collector:	Kelsey and Brown	Kelsey and Brown	Kelsey and Brown	Labay and Kelsey	Kelsey and Brown	Kelsey and Brown	Kelsey et al.
	Locality:	Above Cummings Dam	Below Staples Dam	Between Fentress and Prairie Lea	Just downstream of Prairie Lea	Between Prairie Lea and Stairtown	Above Gaudalupe River confluence	Upstream of Rio Vista Dam
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Micropterus treculi</i>		2	2	2	3	1	1	-
<i>Pomoxis annularis</i>		-	-	-	-	-	2	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	-	-	-	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	1	1	2	-	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepidia</i>		-	-	-	-	-	-	-
<i>Percina apristus</i>		-	10	1	2	-	-	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		1	3	2	4	5	-	3
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	-	-	-	1	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	-	-	-
Total		24	114	44	96	83	91	79

^aCollection not used in analyses

	Source:	6/28/1993	6/30/1993	8/5/1993	6/11/1993	9/25/1993	12/13/1993	12/14/1993
	Collector:	Kelsey and Brown	Kelsey et al	Kelsey and Brown	SWT Ichthyology	Whiteside	Kelsey et al	Kelsey et al
	Locality:	Hwy 90 crossing, WSW of Luling	Below confluence with Blanco River	San Marcos, WWTP	Below Ice House to Westerfield Road	Hays Country	Just downstream of IH-35 crossing	Above Confluence with Blanco River
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997
<i>Lepisosteus oculatus</i>		-	2	1	-	-	-	1
<i>Lepisosteus osseus</i>		1	-	-	1	-	-	1
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		2	4	3	-	-	-	1
<i>Camptostoma anomalum</i>		-	-	-	4	3	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		4	1	10	11	8	-	2
<i>Cyprinus carpio</i>		-	1	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		-	-	-	2	1	-	-
<i>Macrhybopsis marcomis</i>		-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		-	-	25	14	13	2	26
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis bethlemi</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	-	3	2	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	49	5	2	5	1	170
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		43	-	-	2	-	-	-
<i>Carpodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		1	-	-	-	-	-	-
<i>Moxostoma congestum</i>		2	11	9	-	3	5	3
<i>Astyanax mexicanus</i>		-	-	1	3	4	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		-	-	-	1	1	4	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	6/28/1993	6/30/1993	8/5/1993	6/11/1993	9/25/1993	12/13/1993	12/14/1993
	Collector:	Kelsey and Brown	Kelsey et al	Kelsey and Brown	SWT Ichthyology	Whiteside	Kelsey et al	Kelsey et al
	Locality:	Hwy 90 crossing, WSW of Luling	Below confluence with Blanco River	San Marcos, WWTP	Below Ice House to Westerfield Road	Hays Country	Just downstream of IH-35 crossing	Above Confluence with Blanco River
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		2	-	1	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		4	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		-	-	-	1	4	-	-
<i>Gambusia affinis</i>		-	-	-	15	11	47	-
<i>Gambusia geiseri</i>		-	-	-	12	12	66	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	-	4	4	1	-
<i>Poecilia latipinna</i>		-	-	-	5	11	-	1
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	-	1	8	6	13	-
<i>Lepomis auritus</i>		-	16	4	4	6	38	60
<i>Lepomis cyanellus</i>		3	-	-	1	-	3	3
<i>Lepomis gulosus</i>		-	-	-	-	3	-	2
<i>Lepomis macrochirus</i>		22	28	1	3	2	5	18
<i>Lepomis megalotis</i>		8	2	1	-	1	-	-
<i>Lepomis microlophus</i>		-	-	-	-	1	-	-
<i>Lepomis mimatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		2	6	1	6	9	74	17
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		4	-	-	3	1	-	1
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		-	15	2	4	7	28	8
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	6/28/1993	6/30/1993	8/5/1993	6/11/1993	9/25/1993	12/13/1993	12/14/1993
	Collector:	Kelsey and Brown	Kelsey et al.	Kelsey and Brown	SWT Ichthyology	Whiteside	Kelsey et al.	Kelsey et al.
	Locality:	Hwy 90 crossing, WSW of Luling	Below confluence with Blanco River	San Marcos, WWTP	Below Ice House to Westerfield Road	Hays Country	Just downstream of IH-35 crossing	Above Confluence with Blanco River
	Source:	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997
<i>Micropterus treculii</i>		5	5	-	-	1	4	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	-	-	15	1	2	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		-	-	-	10	5	-	1
<i>Percina carbonaria</i>		-	-	-	1	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		-	-	1	6	7	2	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		1	1	-	2	8	-	-
<i>Cichlasoma nigrofasciatum</i>		-	-	-	1	1	-	-
<i>Oreochromis aureus</i>		-	-	-	-	-	5	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp.</i>		-	-	-	-	5	-	-
Total		104	141	66	144	146	300	315

^aCollection not used in analyses

	Source:	12/16/1993	12/20/1993	1/1/1994	1/3/1994	1/4/1994	3/29/1994	3/29/1994
	Collector:	Kelsey et al	Kelsey and Brown	Whiteside	Kelsey et al	Kelsey and Brown	Kelsey et al	Kelsey et al
	Locality:	Below confluence with Blanco River	At Linebarger's Ranch	Hays Country	Downstream of Luling Dam	One mile above Guadalupe River	San Marcos, Thompson Island	Below confluence with Blanco River
	Source:	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Lepisosteus oculatus</i>		3	-	-	1	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		15	-	-	1	19	-	16
<i>Campostoma anomalum</i>		-	-	2	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	15	1	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		217	33	2	38	-	-	11
<i>Cyprinus carpio</i>		-	1	-	1	1	-	3
<i>Dionda nigrotaeniata</i>		-	-	5	-	-	-	-
<i>Macrhybopsis marcomis</i>		5	-	-	1	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		224	72	25	3	3	-	1
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis buchanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		-	-	2	-	-	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		42	25	5	-	-	-	-
<i>Notropis sp</i>		-	-	-	-	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	5	1	-	-
<i>Carpiodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	2	-	1
<i>Moxostoma congestum</i>		14	26	-	-	-	2	3
<i>Astyanax mexicanus</i>		-	-	15	-	-	-	-
<i>Ameiurus melas</i>		-	-	-	-	-	2	-
<i>Ameiurus natalis</i>		-	-	-	-	-	1	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	12/16/1993	12/20/1993	1/1/1994	1/3/1994	1/4/1994	3/29/1994	3/29/1994
	Collector:	Kelsey et al	Kelsey and Brown	Whiteside	Kelsey et al	Kelsey and Brown	Kelsey et al	Kelsey et al
	Locality:	Below confluence with Blanco River	At Linebarger's Ranch	Hays Country	Downstream of Luling Dam	One mile above Guadalupe River	San Marcos, Thompson Island	Below confluence with Blanco River
	Source:	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		1	8	1	4	4	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	1	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	-	-
<i>Fundulus notatus</i>		1	-	-	1	-	-	-
<i>Gambusia affinis</i>		2	5	7	1	-	15	-
<i>Gambusia geiseri</i>		1	-	11	-	-	2	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	-	-
<i>Poecilia formosa</i>		-	-	1	-	-	-	1
<i>Poecilia latipinna</i>		2	-	11	-	1	-	-
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		-	1	5	-	-	10	-
<i>Lepomis auritus</i>		29	14	10	-	-	26	-
<i>Lepomis cyanellus</i>		-	3	-	4	-	-	-
<i>Lepomis gulosus</i>		10	-	-	6	1	-	3
<i>Lepomis macrochirus</i>		14	8	6	28	6	-	18
<i>Lepomis megalotis</i>		11	10	-	23	8	-	14
<i>Lepomis microlophus</i>		1	1	1	1	-	-	-
<i>Lepomis mimatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		1	1	4	-	-	46	3
<i>Lepomis sp</i>		-	-	-	-	-	-	-
<i>Micropterus dolomieu</i>		-	2	-	-	-	-	-
<i>Micropterus punctulatus</i>		1	3	-	2	1	-	-
<i>Micropterus salmoides</i>		9	4	1	3	1	7	4
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

Source:	12/16/1993	12/20/1993	1/1/1994	1/3/1994	1/4/1994	3/29/1994	3/29/1994
Collector:	Kelsey et al.	Kelsey and Brown	Whiteside	Kelsey et al.	Kelsey and Brown	Kelsey et al.	Kelsey et al.
Locality:	Below confluence with Blanco River	At Linebarger's Ranch	Hays Country	Downstream of Luling Dam	One mile above Guadalupe River	San Marcos, Thompson Island	Below confluence with Blanco River
Source:	Kelsey 1997	Kelsey 1997	Permit No SPR-0990- 277	Kelsey 1997	Kelsey 1997	Kelsey 1997	Kelsey 1997
<i>Micropterus treculi</i>	4	2	-	3	1	-	2
<i>Pomoxis annularis</i>	-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>	-	-	-	-	1	-	-
<i>Etheostoma fonticola</i>	-	-	3	-	-	-	-
<i>Etheostoma lepidum</i>	-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>	8	-	-	-	-	-	-
<i>Percina carbonaria</i>	2	-	1	-	-	-	-
<i>Percina macrolepida</i>	-	-	-	-	-	-	-
<i>Percina apristus</i>	4	-	1	1	-	-	-
<i>Percina shumardi</i>	-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>	6	1	3	1	-	-	1
<i>Cichlasoma nigrofasciatum</i>	-	-	-	-	-	-	-
<i>Oreochromis aureus</i>	-	-	-	-	-	2	-
<i>Oreochromis mossambicus</i>	-	-	1	-	-	-	-
<i>Oreochromis sp.</i>	-	-	-	-	-	-	-
Total	627	220	123	143	52	113	81

^aCollection not used in analyses

	Source:	1/1/1995	1/1/1996	1/1/1997	1/1/1999	1/1/2000	1/1/2001	4/6/2001 ^a
	Collector:	Whiteside	Whiteside	Paul Price	Whiteside	Whiteside	Oborny	TPWD
	Locality:	Hays Country	Hays Country	Hays, Guadalupe, Caldwell counties	Hays Country	Hays Country	Spring lake outflow to IH-35	At CR101
	Source:	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0990- 292	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0101- 131	TNHC
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Campostoma anomalum</i>		11	3	4	4	1	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	88	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		10	14	173	1	9	6	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		8	2	-	2	2	5	4
<i>Macrhybopsis marcomis</i>		-	-	18	-	-	-	-
<i>Notemigonus crysoleucas</i>		1	-	-	-	-	-	-
<i>Notropis amabilis</i>		18	6	16	5	15	11	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis burchanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		1	1	-	2	2	8	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		2	2	175	1	5	-	-
<i>Notropis sp</i>		-	-	-	-	-	2	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	28	3	2	-	-
<i>Carpionodes carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		-	-	3	1	1	1	-
<i>Astyanax mexicanus</i>		12	3	-	4	6	1	-
<i>Ameiurus melas</i>		-	-	-	-	-	-	-
<i>Ameiurus natalis</i>		2	-	-	-	1	9	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	1/1/1995	1/1/1996	1/1/1997	1/1/1999	1/1/2000	1/1/2001	4/6/2001 ^a
	Collector:	Whiteside	Whiteside	Paul Price	Whiteside	Whiteside	Oborny	TPWD
	Locality:	Hays Country	Hays Country	Hays, Guadalupe, Caldwell counties	Hays Country	Hays Country	Spring lake outflow to IH-35	At CR101
	Source:	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0990- 292	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0101- 131	TNHC
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	27	1	3	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	1	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		-	-	-	-	-	5	-
<i>Fundulus notatus</i>		-	-	-	-	4	-	-
<i>Gambusia affinis</i>		6	10	97	4	4	-	2
<i>Gambusia geiseri</i>		18	22	2	-	25	-	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		-	-	-	-	-	3521	-
<i>Poecilia formosa</i>		1	5	-	2	2	-	14
<i>Poecilia latipinna</i>		15	5	15	2	20	67	11
<i>Poecilia sp</i>		-	-	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	1
<i>Ambloplites rupestris</i>		3	2	-	1	2	46	-
<i>Lepomis auritus</i>		15	8	7	4	12	16	-
<i>Lepomis cyanellus</i>		-	1	-	1	1	1	-
<i>Lepomis gulosus</i>		-	2	-	3	2	6	-
<i>Lepomis macrochirus</i>		4	8	1	2	5	27	7
<i>Lepomis megalotis</i>		-	1	1	2	1	3	-
<i>Lepomis microlophus</i>		-	1	-	1	1	-	-
<i>Lepomis mimatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		6	3	1	1	5	101	-
<i>Lepomis sp</i>		-	-	-	-	-	24	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	1	-	-	-
<i>Micropterus salmoides</i>		3	4	2	2	4	15	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	1/1/1995	1/1/1996	1/1/1997	1/1/1999	1/1/2000	1/1/2001	4/6/2001 ^a
	Collector:	Whiteside	Whiteside	Paul Price	Whiteside	Whiteside	Oborny	TPWD
	Locality:	Hays Country	Hays Country	Hays, Guadalupe, Caldwell counties	Hays Country	Hays Country	Spring lake outflow to IH-35	At CR101
	Source:	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0990- 292	Permit No SPR-0990- 277	Permit No SPR-0990- 277	Permit No SPR-0101- 131	TNHC
<i>Micropterus treculii</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		-	1	-	1	1	421	-
<i>Etheostoma lepidum</i>		-	-	-	-	-	-	-
<i>Etheostoma spectabile</i>		3	-	11	1	2	-	-
<i>Percina carbonaria</i>		-	-	-	-	-	-	-
<i>Percina macrolepida</i>		-	1	-	1	-	-	-
<i>Percina apristis</i>		3	3	66	2	5	2	-
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		7	1	16	4	6	4	-
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		-	1	-	-	-	2	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp</i>		-	-	-	-	-	-	-
Total		149	110	752	59	149	4304	39

^aCollection not used in analyses

	Source:	1/1/2002	1/1/2003	1/1/2004	1/1/2005	1/1/2006	No Date ^a	No Date ^a
	Collector:	Oborny	Oborny	Oborny	Oborny	Oborny	Clayton	Clayton
	Locality:	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Dam at Rio Vista Park, San Marcos	Near San Marcos
	Source:	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	UMMZ	UMMZ
<i>Lepisosteus oculatus</i>		-	-	-	-	-	-	-
<i>Lepisosteus osseus</i>		-	-	-	-	-	-	-
<i>Anguilla rostrata</i>		-	-	-	-	-	-	-
<i>Dorosoma cepedianum</i>		-	-	-	-	-	-	-
<i>Camptostoma anomalum</i>		-	-	-	-	-	-	-
<i>Carassius auratus</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis</i>		-	-	-	-	-	-	-
<i>Cyprinella lutrensis X venusta</i>		-	-	-	-	-	-	-
<i>Cyprinella venusta</i>		-	-	-	-	-	-	-
<i>Cyprinus carpio</i>		-	-	-	-	-	-	-
<i>Dionda nigrotaeniata</i>		6	6	-	2	6	-	-
<i>Macrhybopsis marconis</i>		-	-	-	-	-	-	-
<i>Notemigonus crysoleucas</i>		-	-	-	-	-	-	-
<i>Notropis amabilis</i>		1	1	-	-	4	17	-
<i>Hybopsis amnis</i>		-	-	-	-	-	-	-
<i>Notropis burchanani</i>		-	-	-	-	-	-	-
<i>Notropis chalybaeus</i>		3	3	5	12	21	-	-
<i>Notropis stramineus</i>		-	-	-	-	-	-	-
<i>Notropis volucellus</i>		-	-	-	-	-	-	-
<i>Notropis sp</i>		-	-	2	4	-	-	-
<i>Opsopoeodus emiliae</i>		-	-	-	-	-	-	-
<i>Pimephales promelas</i>		-	-	-	-	-	-	-
<i>Pimephales vigilax</i>		-	-	-	-	-	-	-
<i>Carpodacus carpio</i>		-	-	-	-	-	-	-
<i>Ictiobus bubalus</i>		-	-	-	-	-	-	-
<i>Moxostoma congestum</i>		1	1	-	-	-	-	-
<i>Astyanax mexicanus</i>		5	1	-	6	2	-	-
<i>Ameiurus melas</i>		1	1	-	-	-	-	-
<i>Ameiurus natalis</i>		16	15	10	2	12	-	-
<i>Ictalurus furcatus</i>		-	-	-	-	-	-	-
<i>Ictalurus lupus</i>		-	-	-	-	-	-	-

	Source:	1/1/2002	1/1/2003	1/1/2004	1/1/2005	1/1/2006	No Date ^a	No Date ^a
	Collector:	Oborny	Oborny	Oborny	Oborny	Oborny	Clayton	Clayton
	Locality:	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Dam at Rio Vista Park, San Marcos	Near San Marcos
	Source:	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	UMMZ	UMMZ
<i>Ictalurus nebulosus</i>		-	-	-	-	-	-	-
<i>Ictalurus punctatus</i>		-	-	-	-	-	-	-
<i>Ictalurus sp</i>		-	-	-	-	-	-	-
<i>Noturus gyrinus</i>		-	-	-	-	-	-	-
<i>Noturus nocturnus</i>		-	-	-	-	-	-	-
<i>Pylodictis olivaris</i>		-	-	-	-	-	-	-
<i>Hypostomus sp</i>		2	2	3	2	4	-	-
<i>Fundulus notatus</i>		-	-	-	-	-	-	-
<i>Gambusia affinis</i>		-	-	-	-	9881	10	-
<i>Gambusia geiseri</i>		-	-	-	-	-	13	-
<i>Gambusia georgei</i>		-	-	-	-	-	-	-
<i>Gambusia sp</i>		677	581	621	1394	-	-	-
<i>Poecilia formosa</i>		-	-	-	-	-	-	-
<i>Poecilia latipinna</i>		19	2	3	11	7	-	-
<i>Poecilia sp</i>		-	13	-	-	-	-	-
<i>Cyprinodon variegatus</i>		-	-	-	-	-	-	-
<i>Menidia beryllina</i>		-	-	-	-	-	-	-
<i>Ambloplites rupestris</i>		70	59	31	53	42	-	1
<i>Lepomis auritus</i>		6	4	6	3	3	-	-
<i>Lepomis cyanellus</i>		1	1	1	1	-	-	-
<i>Lepomis gulosus</i>		3	3	5	3	2	-	3
<i>Lepomis macrochirus</i>		14	14	6	2	2	-	-
<i>Lepomis megalotis</i>		-	-	-	-	-	-	1
<i>Lepomis microlophus</i>		-	-	-	-	-	-	1
<i>Lepomis miniatus</i>		-	-	-	-	-	-	-
<i>Lepomis punctatus</i>		130	81	82	42	130	-	-
<i>Lepomis sp</i>		27	20	10	14	15	-	-
<i>Micropterus dolomieu</i>		-	-	-	-	-	-	-
<i>Micropterus punctulatus</i>		-	-	-	-	-	-	-
<i>Micropterus salmoides</i>		6	5	3	2	3	-	-
<i>Micropterus sp X sp</i>		-	-	-	-	-	-	-

	Source:	1/1/2002	1/1/2003	1/1/2004	1/1/2005	1/1/2006	No Date ^a	No Date ^a
	Collector:	Oborny	Oborny	Oborny	Oborny	Oborny	Clayton	Clayton
	Locality:	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Spring lake outflow to IH-35	Dam at Rio Vista Park, San Marcos	Near San Marcos
	Source:	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	Permit No SPR-0101-131	UMMZ	UMMZ
<i>Micropterus treculi</i>		-	-	-	-	-	-	-
<i>Pomoxis annularis</i>		-	-	-	-	-	-	-
<i>Pomoxis nigromaculatus</i>		-	-	-	-	-	-	-
<i>Etheostoma fonticola</i>		247	208	150	107	477	14	-
<i>Etheostoma lepidum</i>		-	-	-	-	1	-	-
<i>Etheostoma spectabile</i>		-	-	-	-	-	-	-
<i>Percina carbonaria</i>		1	1	-	-	-	-	-
<i>Percina macrolepida</i>		-	-	-	-	-	-	-
<i>Percina apristis</i>		6	4	-	1	-	21	2
<i>Percina shumardi</i>		-	-	-	-	-	-	-
<i>Cichlasoma cyanoguttatum</i>		2	2	3	-	23	-	4
<i>Cichlasoma nigrofasciatum</i>		-	-	-	-	-	-	-
<i>Oreochromis aureus</i>		1	-	-	-	-	-	-
<i>Oreochromis mossambicus</i>		-	-	-	-	-	-	-
<i>Oreochromis sp</i>		-	1	-	-	-	-	-
Total		1245	1029	941	1661	10635	75	12

^aCollection not used in analyses

VITA

Joshuah S. Perkin was born September 7, 1982 in Abilene, Texas. After graduating from Cooper High School in 2001, he attended Cisco Junior College, Hardin Simmons University, and finally Texas State University-San Marcos, where he received his Bachelor of Science in Aquatic Biology in 2006. During this time, Josh worked as a fish ecologist for the Texas Parks & Wildlife Department, The Caddo Lake Institute, and Texas State University-San Marcos. Since January 2007, Josh has researched conservation of imperiled stream-dwelling fishes in the Aquatic Biology graduate degree program at Texas State University-San Marcos. In April 2009 Josh accepted an ecology and evolutionary biology doctoral student position at Kansas State University.

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