# HISTORICAL DATA REVIEW
# ON
# GARCITAS CREEK TIDAL

Performed as part of the Tidal Stream Use Assessment
under TCEQ Contract No. 582-2-48657 (TPWD Contract No. 108287)

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## Introduction

This historical data review was performed as part of an assessment of aquatic life use attainability for three tidally-influenced streams in Texas. The work was performed by Texas Parks and Wildlife Department (TPWD) under contract with the Texas Commission on Environmental Quality (TCEQ). Funding for the contract is from the United States Environmental Protection Agency (USEPA). Under the contract, TPWD Resource Protection Division staff, led by the Water Quality and Coastal Studies Programs, will collect data on five tidal streams. This data will be used to determine the appropriate aquatic life use of three tidal streams, Cow Bayou Tidal, Tres Palacios Creek Tidal and Garcitas Creek Tidal.

Tidal streams serve as nursery grounds for many types of fish and shellfish, including important commercial and sport species. As tidal streams become healthier, the health of Texas bays and estuaries, and the Gulf of Mexico, will also improve.

Numerous tidal streams are included on the state's list of impaired waters. Inclusion on the list of impaired waters initiates the Total Maximum Daily Load (TMDL) process. As a first step in the TMDL process, it is necessary to assess the water body, and determine if the impairment is genuine, and if so, whether or not it is caused by pollutants. It is difficult to do this for tidal streams, because there is no generally accepted methodology for performing the assessment. The TCEQ and TPWD have jointly recognized the need for developing a methodology for assessing the health of tidal streams. The data collected as part of this project will ultimately be analyzed to make recommendations regarding aquatic life uses in use attainability analysis (UAA) reports for Cow Bayou Tidal, Tres Palacios Creek Tidal and Garcitas Creek Tidal.

The Tidal Streams Use Attainability Assessment project will be conducted through FY2006. In 2003 and 2004 TPWD staff will collect data about flow, physico-chemical parameters, fish, shellfish, benthic invertebrates, sediment, habitat, and water chemistry for Cow Bayou Tidal, Garcitas Creek Tidal, Tres Palacios Creek Tidal and two reference streams. In FY2005, TPWD staff will analyze data and prepare a methodology to assess the ecosystem health of Cow Bayou Tidal, Garcitas Creek Tidal, Tres Palacios Creek Tidal. In FY2006, staff will prepare aquatic life use attainability assessment reports.

## Site Description

Garcitas Creek originates in De Witt County, flows through Victoria County, and eventually forms part of the boundary between Victoria and Jackson County before reaching Lavaca Bay. The tidally-influenced portion of the stream probably extends just upstream of its confluence with Arenosa Creek.

Twidwell and Davis (1989) described the Garcitas Creek watershed as nearly level to gently sloping. Elevation increases to the north northwest. Most of the land in the watershed is rangeland, but some cultivation of sorghum, rice, and corn crops also occurs. Commercial production of oil and gas in the area began in the early 1930's and remains important economically. The climate is subtropical humid, and annual precipitation averages 38 inches with September the wettest month. Rainfall is evenly distributed throughout the year, with peaks occurring in spring due to increased thunderstorm activity and in fall due to tropical disturbances. Throughout the upper reaches, Garcitas Creek is bordered by narrow wooded belts consisting chiefly of post oak and live oak trees. The canopies of these bordering trees afford substantial shading to creek waters and limit the development of understory vegetation. The trees quickly thin to prairie riparian areas that are utilized for grazing cattle. In tidally influenced areas of Garcitas Creek the water is more turbid than the upstream portion and the stream channel is wide and nearly straight. The stream banks are low and heavily wooded; however their canopies do not shade the water surface due to the width of the stream channel. Bottom substrates are nearly uniform, consisting of fine sand. Although the upper banks and riparian areas are heavily wooded, the lower banks are moderately vegetated by coarse grasses, vines, and weeds with many open and broken down areas. Water depth is greater in the tidal portion than upstream, but observable instream cover is sparse.

There are no point source discharges directly into Garcitas Creek. There is a small community near the mouth of Garcitas Creek which relies on septic systems for domestic wastewater treatment.

## Water Quality Standards

Water quality standards include designated uses for a water body, specific numerical criteria for certain water quality parameters, and narrative criteria. The Texas Surface Water Quality Standards (TSWQS) are set by the TCEQ and approved by the USEPA. The TCEQ has established aquatic life uses and associated criteria for all waters of the state. The numeric criterion for dissolved oxygen is a surrogate or indirect measure of whether the aquatic life use is being maintained. Adequate dissolved oxygen is necessary for a healthy aquatic community. Most aquatic organisms become stressed if oxygen levels below about 2 mg/l persist for very long.

Garcitas Creek Tidal is an unclassified tributary of Lavaca Bay, Segment 2453, referred to as Segment 2453A. As such, it has a presumed high aquatic life use (Texas Natural Resource Conservation Commission 2000b: 30 TAC §307.4(h)(3)). The dissolved oxygen criteria for a tidal water body with a high aquatic life use are: daily average 4 mg/l, and daily minimum 3 mg/l (30 TAC §307.7(b)(3)(A)(i)). The daily average is evaluated as a minimum average across 24 hours. Since most data collected at fixed monitoring stations are instantaneous measurements, direct comparison to the 24-hour criteria is not possible. For Garcitas Creek, 4.0 mg/l is used as the single measurement screening level to evaluate whether the high aquatic life use is being met (TNRCC, 1999). The dissolved oxygen criteria only apply in the "mixed surface layer," which in tidally-influenced water bodies is defined as "the portion of the water column from the surface to the depth at which the specific conductance is 6,000 umhos/cm greater than the specific conductance at the surface" (TNRCC, 1999). However, the TSWQS at 30 TAC 307.9(c)(3)(C) also specify that a composite sample from the mixed surface layer be used to determine standards attainment when stratification is caused by temperature (density stratification).

**Review of Previous Studies**

TCEQ's predecessor agencies conducted two studies which included assessments of Garcitas Creek Tidal. The studies were focussed on assessing aquatic life uses of smaller, unclassified streams. The earlier work (Twidwell and Davis 1989) was a pilot study of six unclassified streams selected to represent different ecoregions in Texas. Garcitas Creek was sampled both in the tidal reach and above tidal. Good water quality, including very good dissolved oxygen values, were noted. Other characteristics of the water quality noted during the study included: low levels of oxygen demanding materials, nutrients, and bacteria. Benthic macroinvertebrates and fish were sampled at two stations in Garcitas Creek, one in the tidal portion and one in the above-tidal portion. Benthic macroinvertebrates were sampled with Surber samplers in riffle areas and Ekman dredges in deeper water. For Garcitas Creek, fish were collected with seining, gill netting, and electrofishing. The communities sampled were evaluated based on indices developed for use in freshwater streams. For the benthic macroinvertebrate data the station in the above-tidal reach was rated exceptional, while the tidal station was rated high. The fish community was rated intermediate to high in the freshwater portion of Garcitas Creek, and high in the tidal portion. The study acknowledged multiple difficulties in attempting to apply the criteria developed for freshwater streams to the tidal portion of Garcitas Creek. The conclusion to the assessment of Garcitas Creek also noted that the habitat quality index developed by the Texas Water Commission (TWC) was not appropriate to use on the estuarine portions of tidal streams. The final assessment was that the aquatic life use for both the freshwater and saltwater portions of Garcitas Creek should be high.

A follow-up study conducted a couple of years later returned to Garcitas Creek (Bowman 1991). The study site was located approximately four miles upstream from Lavaca Bay, and the site was sampled in November, March, May, and August. Dissolved oxygen stratification was noted in May and August, to the extent that bottom water held 0.2 mg/l dissolved oxygen or less. The bottom water was also observed to be saltier. Nekton were collected by cast net, and the sample was dominated by white shrimp and Gulf menhaden. Data showing nekton species and numbers sampled is included in Appendix A at the end of this document. The author noted that applying some of the metrics used in freshwater assessments (species diversity, species richness, and standing crop) to the nekton community resulted in low scores. However the study concluded that it was well known that tidal streams are extremely productive biologically and important to estuarine systems as nursery areas, and that biological criteria for evaluating tidal streams have not been developed.

Data from these and other studies support the designation of both Garcitas Creek and its tributary, Arenosa Creek, as high to exceptional quality sites for water quality and aquatic life (Bayer et al. 1992). In addition, Garcitas Creek harbors two rare species, the Texas palmetto and diamondback terrapin, and contains extensive estuarine wetland habitat(El-Hage et al. 1999).

West Carancahua Creek, the reference stream for Garcitas Creek, was sampled by TPWD River Studies in 1988 by seine and backpack electrofisher (Linam et al 2002). Twelve fish species were identified from the sample (Appendix B). The same year TCEQ and TPWD sampled West Carancahua Creek using a Surber sampler. Thirty-four taxa of benthic invertebrates were identified (Bayer et al 1992). The list of taxa is attached in Appendix C.

## Review of Water Quality Data

Water quality data from the Surface Water Quality Monitoring (SWQM) portion of the TCEQ Regulatory Activities and Compliance System (TRACS) database was reviewed for the period of record. The focus was on dissolved oxygen measurements, since low oxygen is the reason this water body was suspected to be impaired. The data used in the assessment to list Garcitas Creek Tidal as impaired for dissolved oxygen was also reviewed separately.

### 2000 303(d) Listing of Garcitas Creek Tidal

Garcitas Creek Tidal was listed in 2000 for partial support of the aquatic life use. The procedures for evaluating surface water data to determine whether uses and criteria were being met is described in "2000 Guidance for Screening and Assessing Texas Surface and Finished Water Quality Data." Under this guidance, dissolved oxygen data from the five-year period of record (1994-1999) was compared to the criterion, to determine whether the aquatic life use was being met. Two types of data could be used to assess use support – instantaneous or routinely collected data and 24-hour or intensively collected data. With instantaneous data, at least nine values were required to evaluate whether the criterion was being met, with use being fully, partially, or not met based on the percentage of measurements not meeting the instantaneous screening level (4.0 mg/l in the case of Garcitas Creek Tidal). With 24-hour data, at least five sets of measurements were required to evaluate whether the criterion was being met. Use attainment was evaluated based on the percentages of means and minimum values from those data sets which met the average and minimum criteria established under the TSWQS.

For the 2000 assessment, 13 dissolved oxygen measurements were evaluated; all were taken at Station 13289, Garcitas Creek at FM 616, 2.2 miles southwest of LaSalle. See Figure 1 for locations of stations. All were instantaneous measures of dissolved oxygen. Table 1 summarizes the results of the assessment.

**Table 1. Summary of Dissolved Oxygen Data and Violations of Criteria Assessed for the 2000 Water Quality Inventory and 303(d) List.**

| Station ID | Mean D.O. (mg/l) | N | No. Violations | (%) |
|---|---|---|---|---|
| 13289 | 5.8 | 13 | 3 | 23.1 |

The three violations prompted the listing were measurements of 3.9 mg/l (taken in October 1996), 2.7 (August 1997), and 3.0 (September 1997). Two were taken during hot months of the year (water temperature was 27.4 degrees C for the August sample and 27.2 for the September sample). It may be possible that a larger sample size will show that low dissolved oxygen is not a problem in Garcitas Creek Tidal.

In the 2000 assessment, total phosphorus was also found to be a concern.

### Summary of SWQM TRACS Historical Data

A raw data report of all SWQM data on Segment 2453 was obtained for the period of record ending with June 21, 2002. Over the period of record, dissolved oxygen measurements have been collected at only two stations on Garcitas Creek, Station 13289 (at FM 616) and Station 13290 (at FM 444).

**Mixed surface layer D.O. measurements**

Since dissolved oxygen (D.O.) is the parameter of most concern for this study, an analysis was made of instantaneous D.O. measured at 0.3 meters or less from the surface (to approximate the mixed surface layer). Data collected between 5:00 and 9:00 a.m., which approximates the critical early morning period, was removed from the analysis. The mean D.O. for the remaining 54 measurements was 7.3 mg/l, and values ranged from 2.71 to 13.9 mg/l. Figure 2 shows the mean D.O. and standard deviations for these data by station. Only three measurements were made at Station 13290.

**Critical early morning**

The data set contained only two measurements collected from 5:00 to 9:00 a.m. The values were 5.7 mg/l at Station 13290 and 7.1 mg/l at Station 13289. Both measurements were made in August 1987. These values represent good oxygen levels for the early morning.

**Vertical profiles**

Data from only two sampling events was available to evaluate vertical profiles of dissolved oxygen and specific conductivity, both at station 13289. In October 1973 a profile revealed that the water column was well-mixed and quite fresh. Dissolved oxygen was good throughout the water column (Figure 3). In August 1989 conditions were much saltier at station 13289, and higher conductivities at depth revealed that a salt wedge was present (Figure 4). Dissolved oxygen decreased dramatically as depth increased, such that the water column was practically anoxic below 3 meters.

**Trends Over Time**

Data from the mixed surface layer (measured at 0.3 meters or less from the surface) and collected anytime other than the critical early morning period (5:00 – 9:00 a.m.) was plotted for Station 13289 (Figure 5). Data collection was not continuous over time, with most data points collected in the 1970s, late 1980s, and late 1990s. Compared to the previous years, the dissolved oxygen measurements collected in the late 1990s appeared low, which might imply that the recent measurements are not typical of the stream. Alternatively one might speculate that low values in the late 1990s were caused by recent changes in the watershed, such as an increase in the loading of oxygen-demanding materials to the tidal reach, relative to the preceding twenty years.

**Effects of Nutrients, Suspended Solids, and TOC on Dissolved Oxygen**

TRACS data were requested for sampling events where nutrients (ammonia, nitrate, phosphate), total suspended solids (TSS) and total organic carbon (TOC) were measured along with dissolved oxygen. For Station 13289 the correlation between each of these parameters and dissolved oxygen was evaluated (Table 2). Dissolved oxygen decreased as TOC (Figure 6) and phosphate (Figure 7) increased. However D.O. increased with increasing ammonia as well (Figure 8). There was no discernable trend with nitrate or TSS (Figures 9, 10).

**Table 2. Pearson correlation coefficients between various water quality parameters and dissolved oxygen.**

| | TSS | TOC | NH4 | PO4 | NO3 |
|---|---|---|---|---|---|
| Correlation coefficient (r) | 0.059 | -0.747* | 0.520* | -0.587* | -0.012 |
| Sample size | 36 | 15 | 30 | 20 | 34 |

r : used to quantity the strength of the association between the variables. While positive r values indicate both increase together, negative r values indicate a negative relationship

*: p values < 0.05, hence one variable can be used to predicate the other variable.

**Figure 1. Map of Garcitas Creek Tidal showing TCEQ station locations.**

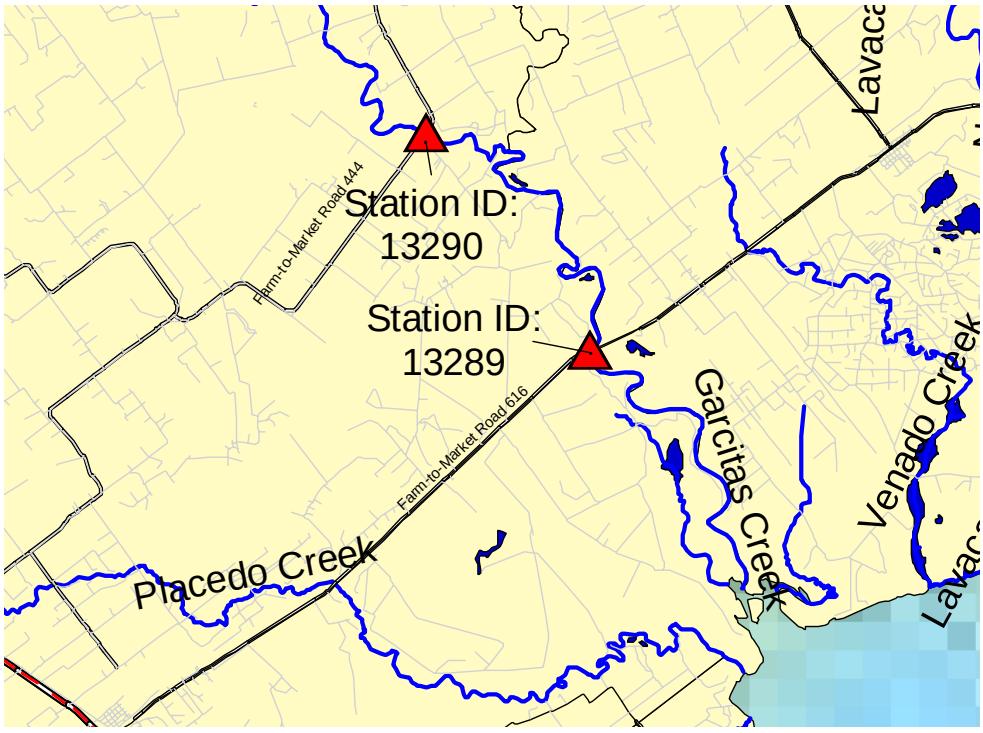


**Figure 2. Mean Surface (<=0.3 m) Dissolved Oxygen Measurements for Period of Record by Station (Mean +/- Std. Dev.)**

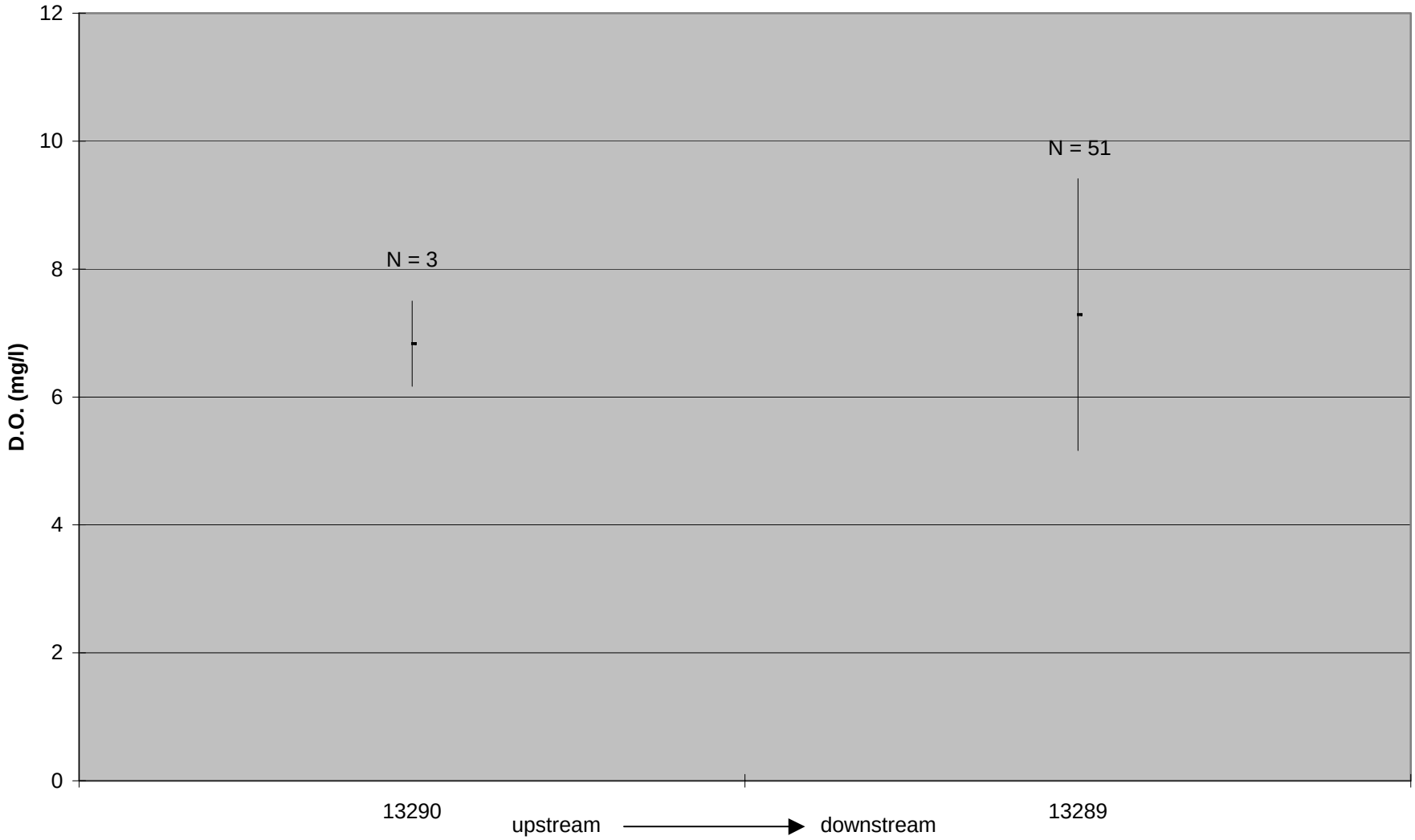


**Figure 3. Garcitas Creek Station 13289: Dissolved oxygen and conductivity on 10/17/73 at 1:00 p.m.**

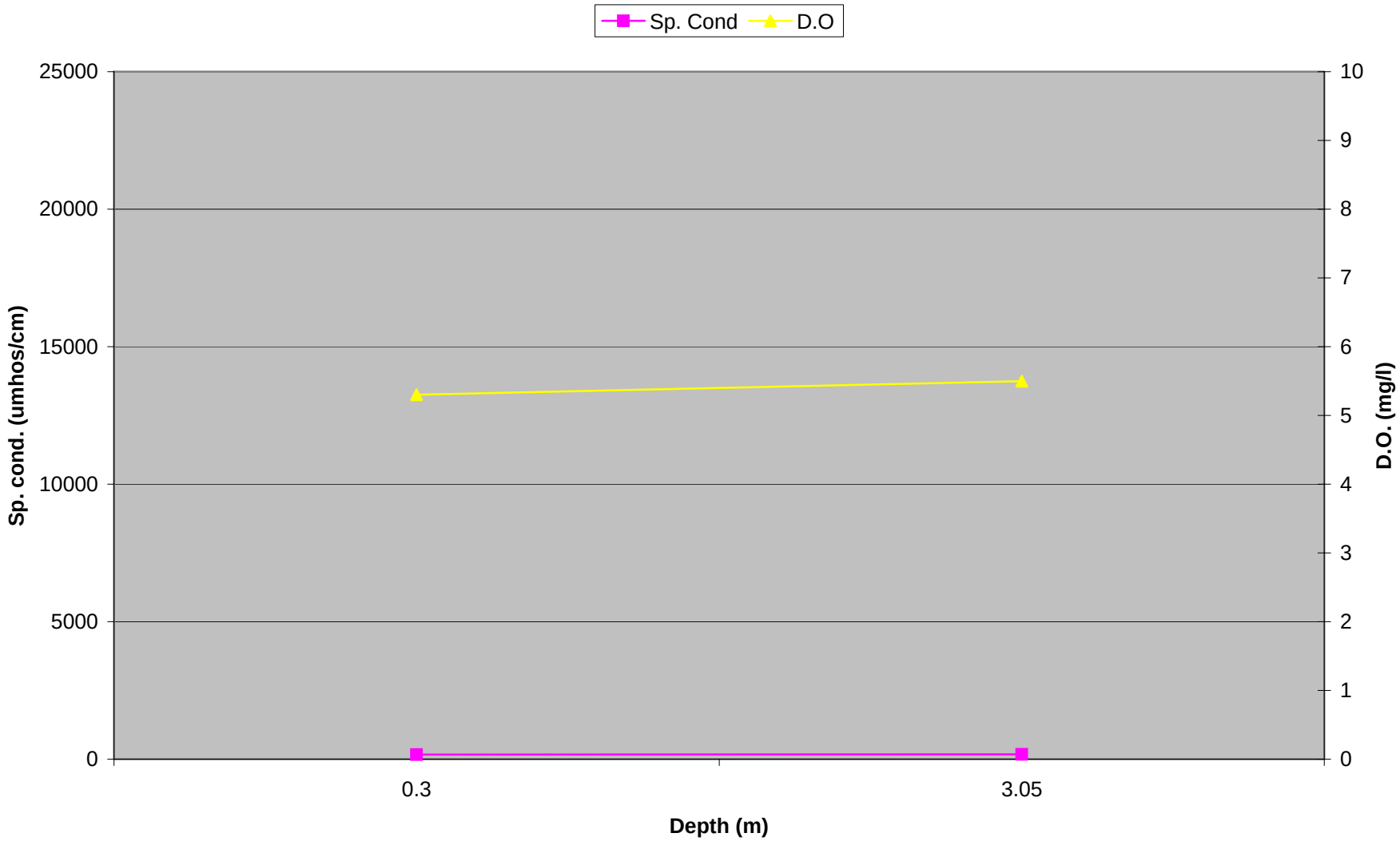


**Figure 4. Garcitas Creek Station 13289: Dissolved oxygen and conductivity on 8/7/89 at 3:56 p.m.**

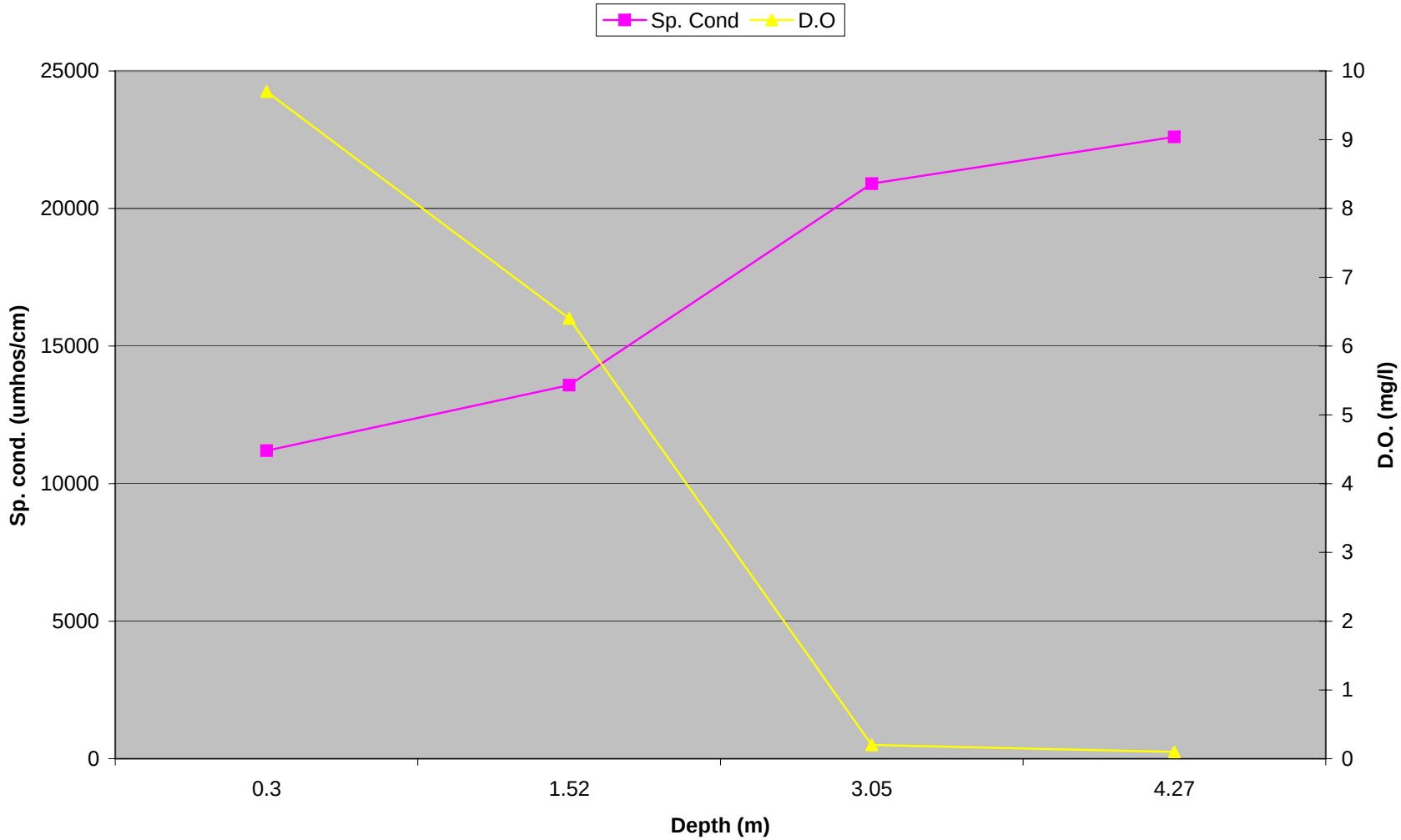


**Figure 5. Mean Dissolved Oxygen at Garcitas Creek Station 13289 (+/- Std. Dev.)**
**N = 51**

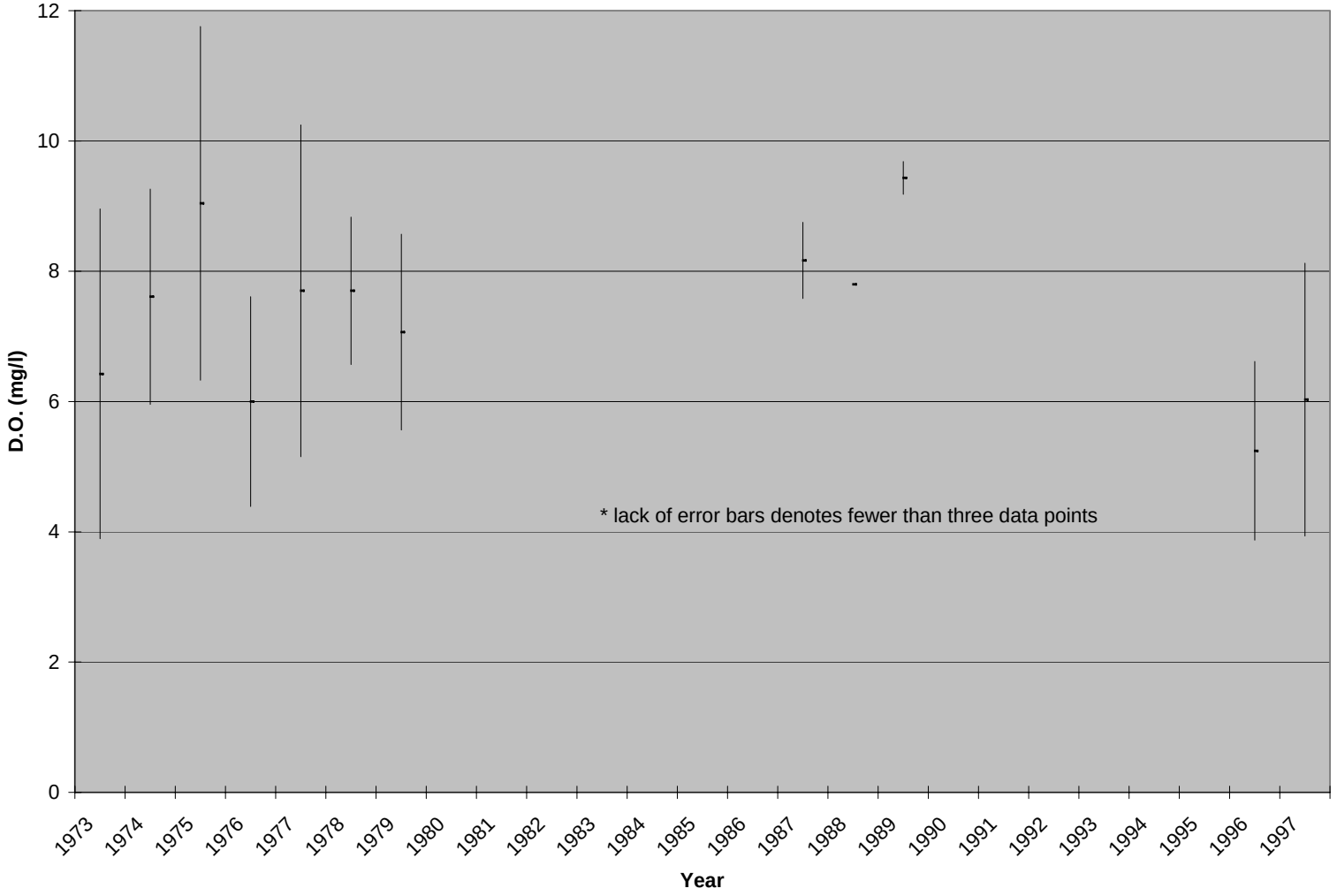


**Figure 6. TOC vs. DO at Garcitas Creek Tidal Station 13289**

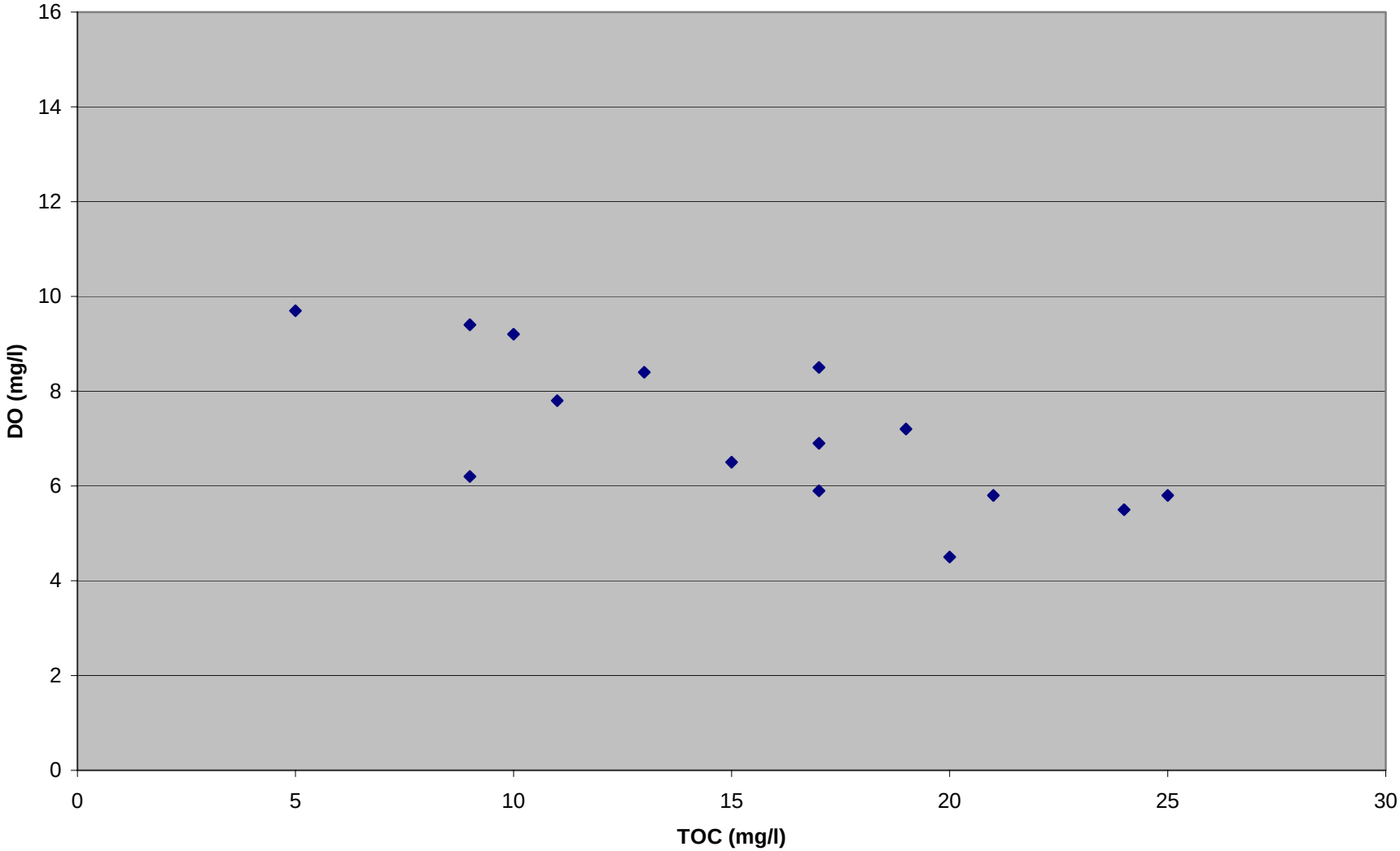


**Figure 7. Phosphate vs. DO at Garcitas Creek Tidal Station 13289**

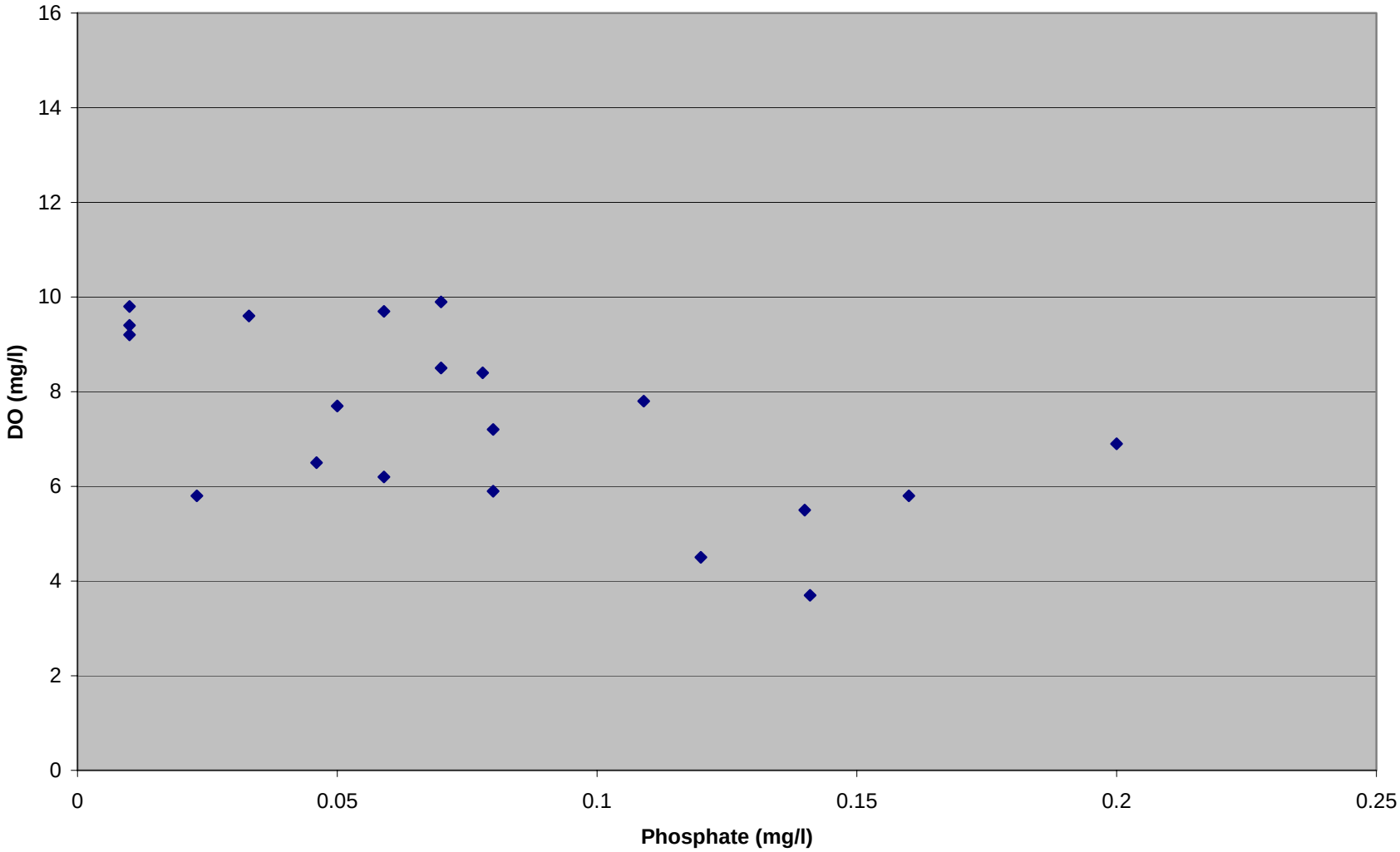


**Figure 8. Ammonia vs. DO at Garcitas Creek Tidal Station 13289**

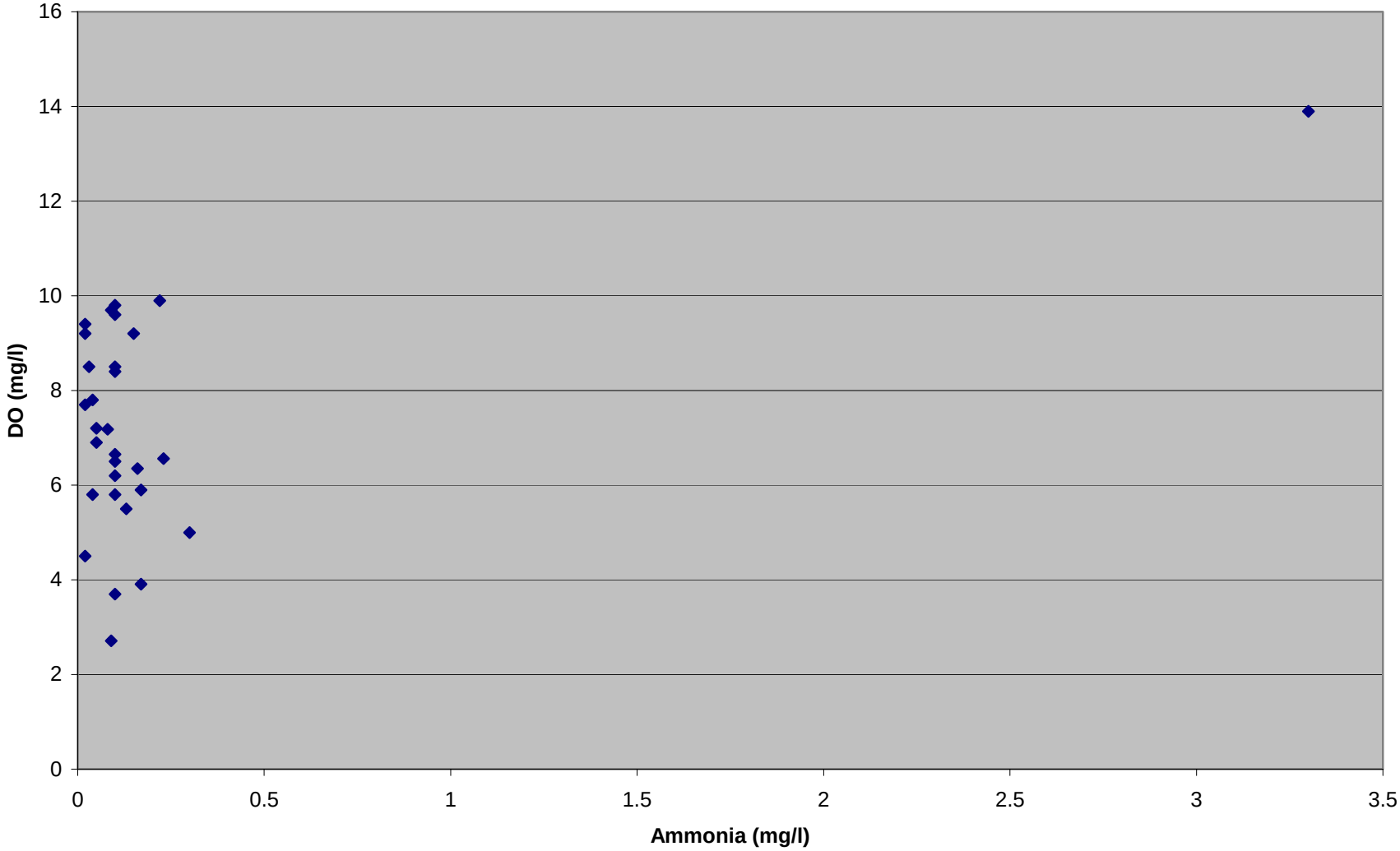


**Figure 9. Nitrate vs. DO at Garcitas Creek Tidal Station 13289**

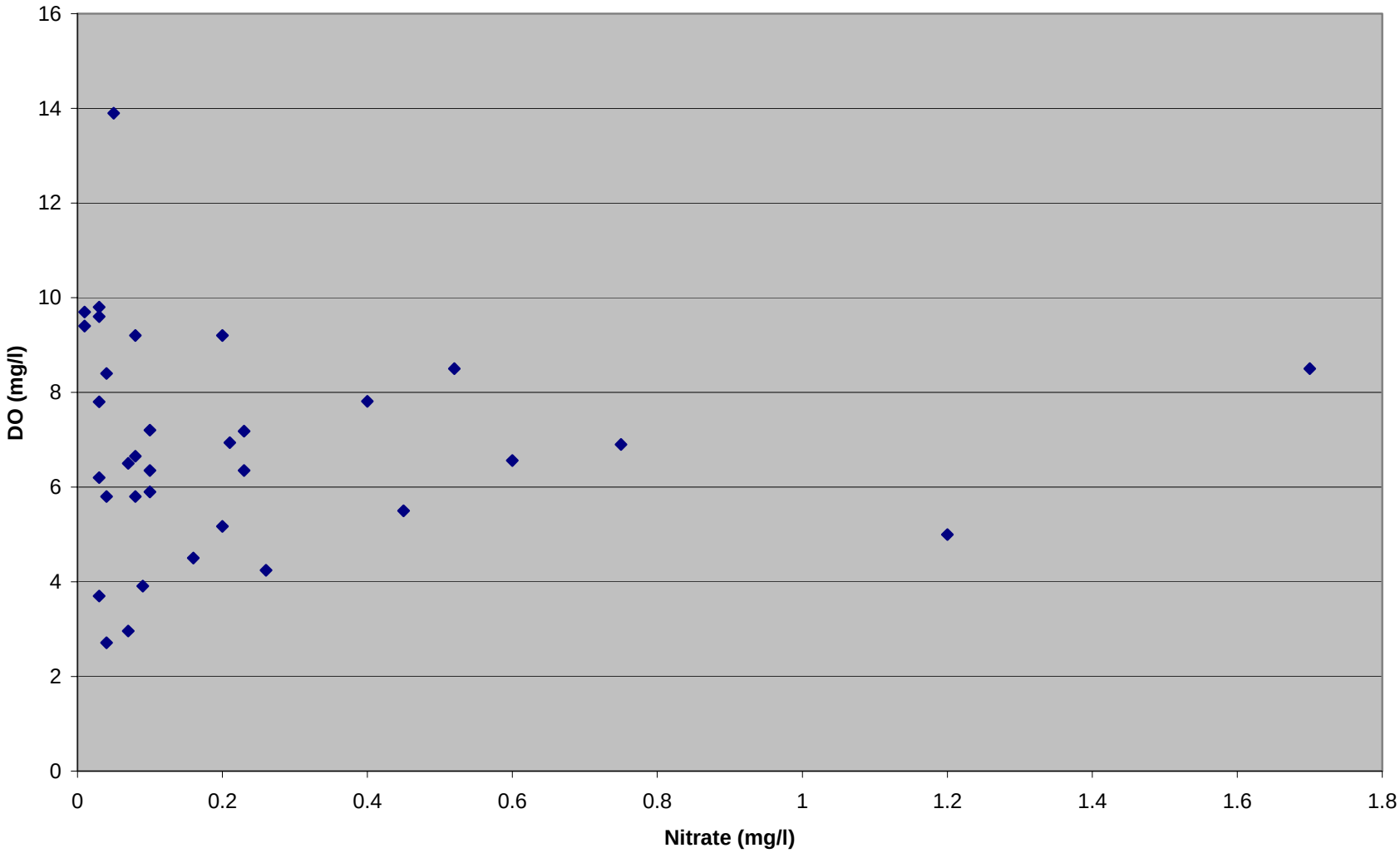
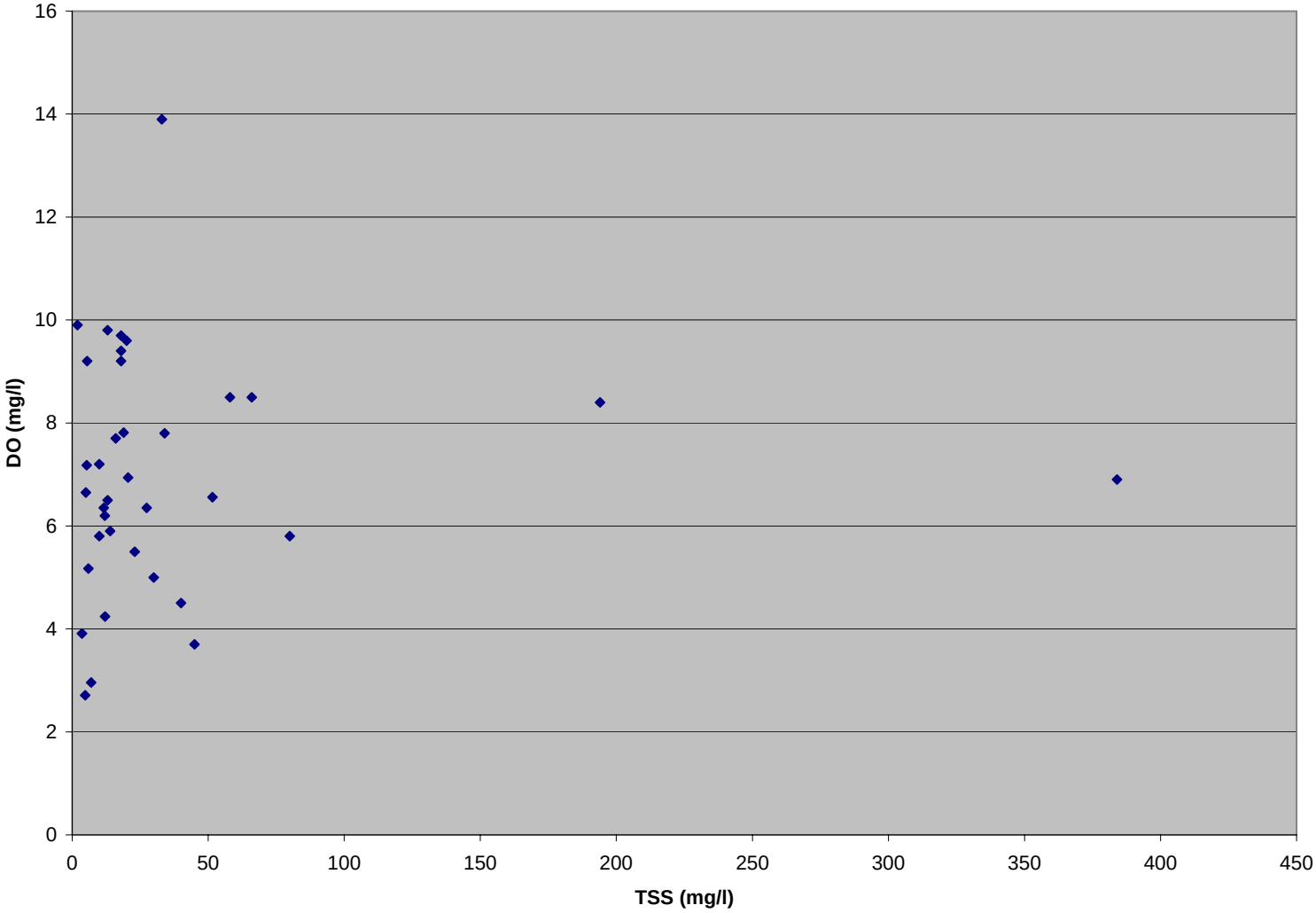


**Figure 10. TSS vs. DO at Garcitas Creek Tidal Station 13289**



## Conclusion

Relative to the other two streams being studied under this contract, there is a limited water quality data set for Garcitas Creek Tidal. The segment was listed as impaired based on only three violations of the criterion, the lowest value of which was 2.7 mg/l. The mean dissolved oxygen for measurements taken within 0.3 meter of the surface was 7.3 mg/l, which is very good. Although there were only two values in the database taken during the critical early morning period, both easily met the water quality criterion for dissolved oxygen. The only situation where dissolved oxygen was measured at extremely low levels was measured in August 1989 near the bottom of the water column.

Biological data on Garcitas Creek Tidal indicates a healthy aquatic community. The assessment is hampered by the lack of appropriate evaluation tools for the tidally-influenced portion of Garcitas Creek.

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APPENDIX A. Table of nekton data from Bowman (1991).

**Table 16.–Nekton (Garcitas Creek Tidal)**

| Species | Common Name | Nov 88 | Mar 89 | May 89 | Aug 89 |
|---|---|---|---|---|---|
| *Anchoa mitchilli* | (Bay Anchovy) | 0 | 2 | 0 | 0 |
| *Brevoortia patronus* | (Gulf Menhaden) | 0 | 2 | 129 | 328 |
| *Callinectes sapidus* | (Blue Crab) | 0 | 0 | 0 | 0 |
| *Cyprinodon variegatus* | (Sheepshead Minnow) | 1 | 0 | 0 | 0 |
| *Dorosoma petenense* | (Threadfin Shad) | 0 | 0 | 0 | 0 |
| *Etheostoma chlorosomum* | (Bluntnose Darter) | 0 | 0 | 0 | 0 |
| *Eucinostomus gula* | (Silver Jenny) | 0 | 0 | 0 | 1 |
| *Fundulus chrysotus* | (Golden Topminnow) | 0 | 0 | 0 | 0 |
| *Fundulus grandis* | (Gulf Killifish) | 3 | 1 | 0 | 9 |
| *Fundulus pulvereus* | (Bayou Killifish) | 2 | 0 | 0 | 0 |
| *Gambusia affinis* | (Mosquito Fish) | 1 | 0 | 0 | 0 |
| *Ictalurus punctatus* | (Channel Catfish) | 0 | 0 | 0 | 0 |
| *Ictiobus bubalus* | (Smallmouth Buffalofish) | 0 | 0 | 0 | 0 |
| *Lagodon rhomboides* | (Pinfish) | 0 | 0 | 1 | 0 |
| *Lepomis macrochirus* | (Bluegill) | 0 | 0 | 0 | 0 |
| *Lepomis marginatus* | (Dollar Sunfish) | 0 | 0 | 0 | 0 |
| *Lepomis punctatus* | (Spotted Sunfish) | 0 | 0 | 0 | 0 |
| *Lepomis sp.* | (Hybrid Sunfish) | 0 | 0 | 0 | 0 |
| *Membras martinica* | (Rough Silverside) | 3 | 0 | 0 | 0 |
| *Micropogon undulatus* | (Atlantic Croaker) | 0 | 0 | 1 | 0 |
| *Micropterus punctulatus* | (Spotted Bass) | 0 | 0 | 0 | 0 |
| *Micropterus salmoides* | (Largemouth Bass) | 0 | 0 | 0 | 0 |
| *Mugil cephalus* | (Striped Mullet) | 0 | 0 | 2 | 1 |
| *Notropis amabilis* | (Texas Shiner) | 0 | 0 | 0 | 0 |
| *Notropis venustus* | (Spottail Shiner) | 0 | 0 | 0 | 0 |
| *Palaemonetes kadiakensis* | (Freshwater Shrimp) | 0 | 2 | 0 | 0 |
| *Penaeus aztecus* | (Brown Shrimp) | 0 | 0 | 4 | 0 |
| *Penaeus duorarum* | (Pink Shrimp) | 2 | 0 | 0 | 0 |
| *Penaeus setiferus* | (White Shrimp) | 44 | 0 | 0 | 3 |
| *Sciaenops ocellata* | (Red Drum) | 0 | 2 | 0 | 0 |
| All Species | | 56 | 9 | 137 | 342 |
| Mean no. species/cast | | 0.7 | 0.5 | 0.5 | 0.5 |
| Mean no. individuals/cast | | 5.6 | 0.9 | 13.7 | 34.2 |
| Mean biomass/cast (g) | | 5.74 | 0.62 | 103.63 | 73.9 |
| Total no. species | | 7 | 5 | 5 | 5 |
| Total no. individuals | | 56 | 9 | 137 | 342 |
| Total biomass (g) | | 57.4 | 6.2 | 1036.3 | 739.8 |
| Density (no. individuals/sq. m) | | | | | |
| Shannon-Weiner diversity | | 0.89 | 1.58 | 0.29 | 0.31 |
| Evenness | | 0.46 | 0.98 | 0.18 | 0.19 |

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APPENDIX B. Data table from Linam et al 2002.

Fish species collected from West Carancahua Creek, Jackson County (9/7/88).

| Species | Common Name | Seine (7 hauls) | Backpack Shocker (10.3 min) |
|---|---|---|---|
| *Anguilla rostrata* | American eel | | 1 |
| *Cyprinella lutrensis* | Red shiner | 1360 | 3 |
| *Opsopoeodus emiliae* | Pugnose minnow | 9 | 1 |
| *Pimephales vigilax* | Bullhead minnow | | 1 |
| *Ameiurus natalis* | Yellow bullhead | | 1 |
| *Ictalurus punctatus* | Channel catfish | 32 | 16 |
| *Noturus gyrinus* | Tadpole madtom | 1 | |
| *Gambusia affinis* | Western mosquitofish | 430 | 2 |
| *Lepomis cyanellus* | Green sunfish | 3 | 9 |
| *Lepomis gulosus* | Warmouth | | 5 |
| *Lepomis macrochirus* | Bluegill | | 2 |
| *Lepomis megalotis* | Longear sunfish | | 1 |

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APPENDIX C. Table from Bayer et al, 1992

TEXAS WATER COMMISSION ECOREGION INVERTEBRATE DATA

STATION 2400.0330
West Caranchua Creek - Jackson Co.
@ Jackson County Rd. 440 (Bonnot Rd.) 5.6 km NE Laward
DATE 09/07/88
ECOREGION 34
SAMPLES 3 sq. ft. Surbers

| Code | Genus/species | No. | No./$M^2$ | No./$ft^2$ |
|---|---|---|---|---|
| 90045 | *Hydra* sp. | 1 | 4 | 0.33 |
| 90077 | *Dugesia tigrina* | 1 | 4 | 0.33 |
| 90501 | *Aulodrilus pigueti* | 2 | 7 | 0.67 |
| 90507 | *Limnodrilus hoffmeisteri* | 11 | 39 | 3.67 |
| 90510 | *Limnodrilus udekemianus* | 11 | 39 | 3.67 |
| 92875 | *Physella virgata* | 1 | 4 | 0.33 |
| 93031 | *Pisidium casertanum* | 29 | 104 | 9.67 |
| 93040 | *Sphaerium transversum* | 153 | 549 | 51 |
| 91101 | *Eucypris* sp. | 2 | 7 | 0.67 |
| 92230 | *Dubiraphia* sp. | 1 | 4 | 0.33 |
| 92242 | *Microcylloepus pusillus* | 2 | 7 | 0.67 |
| 92259 | *Stenelmis occidentalis* | 290 | 1041 | 96.67 |
| 92645 | *Cladotanytarsus* sp. gr. A | 17 | 61 | 5.67 |
| 92502 | *Conchapelopia* sp. | 56 | 201 | 18.67 |
| 90999 | *Cricotopus trifascia* gr. | 26 | 93 | 8.67 |
| 92523 | *Cryptochironomus fulvus* gr. | 13 | 47 | 4.33 |
| 93294 | *Polypedilum convictum* | 77 | 276 | 25.67 |
| 93289 | *Polypedilum illinoense* | 4 | 14 | 1.33 |
| 92635 | *Polypedilum* nr. *scalaenum* sp. B | 17 | 61 | 5.67 |
| 92538 | *Pseudochironomus* sp. | 94 | 337 | 31.33 |
| 92469 | *Saetheria* sp. | 4 | 14 | 1.33 |
| 92423 | *Tanytarsus glabrescens* gr. | 39 | 140 | 13 |
| 92554 | *Tanytarsus* sp. | 4 | 14 | 1.33 |
| 92588 | *Thienemanniella* sp. | 13 | 47 | 4.33 |
| 91663 | *Baetis ephippiatus* | 1 | 4 | 0.33 |
| 91600 | *Caenis* sp. | 149 | 535 | 49.67 |
| 91651 | *Fallceon quilleri* | 17 | 61 | 5.67 |
| 91656 | *Paracloeodes* sp. | 2 | 7 | 0.67 |
| 91595 | *Tricorythodes albilineatus* gr. | 255 | 915 | 85 |
| 91713 | *Erpetogomphus* sp. | 3 | 11 | 1 |
| 91732 | *Progomphus obscurus* | 3 | 11 | 1 |
| 92292 | *Cheumatopsyche* sp. | 59 | 212 | 19.67 |
| 92324 | *Hydroptila* sp. | 18 | 65 | 6 |
| 92399 | *Oecetis* sp. B | 1 | 4 | 0.33 |

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| | | |
|---|---|---|
| 90004 | Number of Species | 34 |
| | Number of Individuals in Sample | 1376 |
| 90007 | Number of Individuals/sq. M | 4937 |
| 90003 | Number of Individuals/sq. ft. | 458.67 |
| 90000 | Diversity | 3.64 |
| 90002 | Redundancy | 0.30 |
| | Max. diversity | 5.09 |
| | Min. diversity | 0.28 |
| 90001 | Equitability | 0.72 |
| 90008 | EPT Index | 8 |
| 90009 | No. of Functional Feeding Groups | 6 |
| 90010 | Dominant Functional Feeding Group (% of Community) | 42.70 |
| 90017 | Cumulative Abundance of FPOM Feeders (% of Community) | 75.42 |
| 90020 | Grazers (% of Community) | 13.76 |
| 90025 | Gatherers (% of Community) | 42.70 |
| 90030 | Filterers (% of Community) | 19.17 |
| 90034 | Miners (% of Community) | 13.55 |
| 90035 | Shredders (% of Community) | 3.36 |
| 90036 | Predators (% of Community) | 7.46 |
| 90037 | Mean Point Score | 3.00 |
| 90038 | Ohio ICI Index Value | 43 |

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